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THESIS

IMPROVED SCREENING FOR NAVY ENLISTMENT

by

John J. Andrew

March 2009

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The Navy uses AFQT score and Educational Tier to determine enlistment eligibility. This thesis presents matrices for screening applicants based on education credential, AFQT score, age, marital status, and dependency status, with the intent of more accurately predicting first-term attrition.

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IMPROVED SCREENING FOR NAVY ENLISTMENT

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I.   INTRODUCTION

A.   BACKGROUND

The Navy has become increasingly concerned with first-term attrition since the advent of the All-Volunteer Force (AVF) in 1973. In the early 1970s, the Navy discharged nearly 30 percent of sailors before they had completed their initial enlistment.[1] Despite all efforts to the contrary, first-term attrition rates increased steadily in the 1980s to over 40 percent by the late 1990s.[2] Recruiting and training a single sailor is estimated to cost approximately $15,000,[3] and the Navy ultimately spends tens of millions of dollars annually to replace recruits lost through attrition. In addition to monetary costs, fleet readiness is hurt through more frequent personnel turnover and lower average experience levels associated with higher attrition.

First-term attrition has been falling since 1999, likely as a result of both economic influences and a concerted effort by Navy leadership to reduce the loss of personnel during the first term. However, it remains important that methods be developed to identify and screen out applicants with a higher propensity to attrite.

The Navy attempted to minimize first-term attrition in the 1970s and 1980s through the use of attrition probability

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[1] Robert F. Lockman, Chances of Surviving the First Year of Service: A New Technique for Use in Making Recruiting Policy and Screening Applicants for the Navy, CNS-1068 (Arlington, VA: Center for Naval Analyses, 1975), 1.

[2] Donald J. Cymrot and Ann D. Parcell, Quantity and Quality of Attrition, (Alexandria, VA: Center for Naval Analyses, 2000), 2.

[3] John Noble, email message to Wayne Wagner, December 8, 2008.

tables developed from its "Odds for Effectiveness (OFE)" and "Success Chances of Recruits Entering the Navy (SCREEN)" models. The Navy's current screening method employs the three-tier educational credential system, introduced by the Department of Defense in the 1980s. This system of screening applicants is based on the relationship between education and attrition that was first identified by Flyer in 1959[4] and which has been corroborated by numerous studies since. Educational Tier is used in conjunction with scores on the Armed Forces Qualification Test (AFQT) to aid in enlisted selection, associating expected potential for success with each particular education credential and aptitude level.

The system was revised in the early 1990s, shifting adult education credentials from Tier II to Tier I, as a compromise to political pressure from supporters of alternative credentials.[5] The system has been modified further in the ensuing years. For example, new credentials were created for individuals who fail state-mandated high school exit exams and for those who complete the GED while participating in Job Corps, both classified as Tier I.[6] Including education credentials that are associated

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[4] Eli S. Flyer, Factors Relating to Discharge for Unsuitability Among 1956 Airman Accessions to the Air Force, WADC-TN-59-201 (Lackland AFB, TX: Personnel Laboratory, Wright Air Development Center, 1959), 15.

[5] Ibid., 3.

[6] Commander, Navy Recruiting Command, Navy Recruiting Manual – Enlisted, Volume II: Eligibility Requirements (Millington, TN: Commander, Navy Recruiting Command, 2008), 2-4-1.

with higher levels of attrition in Tier I degrades the current screening model and makes it far less accurate in predicting attrition.[7]

B.   PURPOSE AND BENEFITS OF THIS STUDY

The primary purpose of this study is to evaluate the first-term attrition rates of Navy enlisted personnel with selected background characteristics to identify variables that are predictive of attrition. Background factors found to be correlated with attrition can then be incorporated into an improved enlistment screening model.

A secondary purpose of this study is to assess the methods used by the Navy to screen enlistment candidates. If parts of past or current methods are found to correlate with attrition, they can be incorporated into the improved model. If any aspects of the current screening system are determined   to   correlate   poorly   with   attrition, recommendations can be offered to either modify these factors or discontinue their use.

The improved screening model presented by this study should allow the Navy to refine its enlistment strategy in accepting fewer candidates who have a relatively high likelihood of attrition. The ultimate benefits of such a screening model would be reduced fiscal waste caused by first-term attrition, improved fleet readiness due to less personnel turnover, and a generally more effective method for selecting the best recruits.

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[7] Eli S. Flyer, "Development of an Enlistment Screening Measure for Navy Recruits," 2008.

C.   ORGANIZATION OF THE THESIS

This thesis contains six chapters. Chapter II presents a review of previous studies related to first-term attrition and the screening methods the military has used to mitigate attrition. Chapter III describes the results of an analysis of Navy first-term attrition and probit regression models used to explain how the different background characteristics of individuals affect attrition likelihood. Chapter IV has an identical focus, structure, and methodology as the previous chapter, but employs a restricted dataset to analyze only individuals who successfully complete the first 90 days of service. Chapter V presents several tables that can be used to possibly improve enlistment screening and reduce first-term attrition. Chapter VI presents a summary of the research, offers conclusions, and provides recommendations for action as well as for future research.

II. LITERATURE REVIEW

The U.S. military has employed various methods to evaluate the aptitudes of applicants for enlistment since World War I.[8] Such evaluation evolved over the years into entry-screening techniques to gauge each recruit's likelihood of success and to eliminate persons who were "high risks."[9] Studies of prospective military enlistees have been conducted since at least the late 1950s, with the ultimate goal of identifying the causes of first-term attrition and developing screening methods to reduce that attrition.

A.   ATTRITION RESEARCH

Flyer is generally recognized as the first to find a positive and strong correlation between education level and unsuitability discharge from the military.[10] Flyer focused on the Air Force. However, by the 1960s, all services were studying premature separation, and all were finding that education level and intelligence, as well as age, were excellent predictors of success in the military.[11]

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[8] Mark J. Eitelberg et al., *Screening for Service: Aptitude and Education Criteria for Military Entry* (Alexandria, VA: Human Resources Research Organization, 1984), 1-11.

[9] Eli Ginzberg et al., *The Ineffective Soldier: Lessons for Management and the Nation, Volume One: The Lost Divisions* (New York: Columbia University Press, 1959), 30-31.

[10] Eli S. Flyer, *Factors Relating to Discharge for Unsuitability Among 1956 Airman Accessions to the Air Force* (Lackland AFB, TX: Personnel Laboratory, Wright Air Development Center, 1959), 4.

[11] Robert F. Lockman, *Enlisted Selection Strategies* (Arlington, VA: Center for Naval Analyses, 1974), 38.

Researchers continued to confirm and expand upon early studies after the advent of the All-Volunteer Force (AVF) in 1973. For example, in 1977, Cooper conducted a comprehensive study and found the following: Failing to complete high school is a good indication of a person's potential disciplinary or motivational problems; Armed Forces Qualification Test (AFQT) category continues to predict relative trainability; and higher levels of both educational attainment and aptitude are correlated with overall satisfactory job performance.[12] Analyzing data from a 1971 cohort of enlisted accessions, Cooper found that the first-term attrition rates for non-high school graduates were nearly three times those of high school graduates, and that AFQT Category IV high school graduates were significantly less likely to attrite than were non-high school graduates in AFQT Categories I-III (see Table 1).[13]

Table 1.   Percent of Enlisted Accessions Discharged for Failure to Meet Minimum Behavior or Performance Criteria: Fiscal 1971 Enlistees Separated as of 20 June 1973 (percent)(From Cooper)

| Education | Mental Category | | | |
	I-II	III	IV	All
HSG	6.6	9.4	13.7	*8.6*
NHSG	20.7	24.5	26.8	*24.6*
All	*8.8*	*15.7*	*21.1*	*14.3*

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[12] Richard V. L. Cooper, *Military Manpower and the All-Volunteer Force* (Santa Monica, CA: RAND Corporation, 1977), 129-130.

[13] Ibid., 140.

Flyer, with Elster, expanded on Flyer's original findings in 1982, when they compared General Education Development (GED) certificate-holders with traditional high school graduates and non-high school graduates. Flyer and Elster found that, while GED holders' AFQT scores were essentially the same as those of high school graduates,[14] GED-holders attrited at twice the rate found for high school graduates.[15] Indeed, the first-term attrition rates of GED-holders were similar to those of non-high school graduates with no such credential.[16] Additionally, the authors found that GED-holders who had completed Job Corps training attrited at nearly the same rate as did those who had not completed such training.[17]

In 1983, Flyer and Elster extended their research and found that married recruits were more likely to attrite than were their single counterparts.[18] The authors also found that attrition rates for 17-year-olds was significantly higher than for 18-22 year-olds, and that recruits older than 22 years also tended to experience higher attrition.[19] Another notable finding in the 1983 study concerns differences in attrition between men and women: Although women tend to attrite at much higher rates than do their

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[14] Richard S. Elster and Eli S. Flyer, *A Study of the Relationship Between Education Credentials and Military Performance Criteria* (Monterey, CA: Naval Postgraduate School, 1982), II-7.

[15] Ibid., II-25.

[16] Ibid., II-38.

[17] Ibid., IV-3.

[18] Eli S. Flyer and Richard S. Elster, *First Term Attrition Among Non-Prior Service Enlisted Personnel: Loss Probabilities Based on Selected Entry Factors* (Monterey, CA: Naval Postgraduate School, 1983), 43.

[19] Ibid., 47.

male counterparts, when pregnancy discharges are removed from consideration, this difference in attrition essentially disappears.[20]

A year later, Buddin corroborated the finding that older recruits tend to attrite at a higher rate. Buddin found that the probability of first-term attrition increased by about one percentage point for each year beyond age 17 the recruit was at time of enlistment.[21] As the author observes: "Older enlistees may be labor market 'misfits' who do worse in the military than one would expect even after controlling for their previous work history."[22]

By the mid-1980s, research on first-term attrition had become a standard ingredient of military manpower studies, due to accumulating problems in recruiting and retaining personnel. All of the research pointed to the importance of education in predicting the likelihood of attrition for a new recruit.[23] Thus, by 1987, the Department of Defense was well-prepared to introduce a service-wide system for categorizing education according to three "tiers."[24] This move simplified an otherwise complicated screening apparatus that varied from military service to military service, and

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[20] Flyer and Elster, 21.

[21] Richard Buddin, *Analysis of Early Military Attrition Behavior* (Santa Monica, CA: RAND Corporation, 1984), 23.

[22] Ibid., 50.

[23] Bernard Rostker, *I Want You: The Evolution of the All-Volunteer Force*, (Santa Monica, CA: RAND Corporation, 2006).

[24] The "Tier" system is described more fully below.

it facilitated a more uniform method for combining the military's education and aptitude standards.[25]

In analyzing Navy enlisted cohorts who entered service from fiscal years 1989 through 2003, Bownds found that recruits with Tier I education credentials (the highest levels of education) attrited at a much lower rate than did those classified as Tier II or Tier III; however, recruits with certain different education credentials within the Tier I classification varied considerably in their likelihood of experiencing attrition.[26] Also, enlistees with Tier II credentials were about as likely to attrite from Navy bootcamp as were Tier III individuals who possessed no education credential at all.[27]

Bownds determined that a recruit who enlisted with a waiver (medical, moral, or legal) was more prone to attrite.[28] Huth confirmed the relationship between moral waivers and attrition in 2007, finding a significant correlation between first-term attrition and such waivers.[29] Huth found that, in the case of otherwise identical recruits who had a higher initial risk of attrition (lower Education

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[25] Defenselink, "Education of AC Enlisted Accessions," U.S. Department of Defense, http://www.defenselink.mil/prhome/ poprep98/html/2-education.html, (accessed February 28, 2009).

[26] Christopher D. Bownds, "Updating the Navy's Recruit Quality Matrix: An Analysis of Educational Credentials and the Success of First-Term Sailors," (Master's thesis, Naval Postgraduate School, Monterey, CA, 2004), 26; 41.

[27] Ibid., 24, 37.

[28] Ibid., 40.

[29] Richard A. Huth, "The Effect of Moral Waivers on the Success of Navy Recruits," (Master's thesis, Naval Postgraduate School, Monterey, CA, 2007), 39.

Tier, lower AFQT, etc.), requiring a moral waiver would increase the probability of attrition by as much as 33 percent.[30]

Neuhalfen conducted a comprehensive study of Navy bootcamp attrition in 2007 and found, not surprisingly, that education credential and AFQT score were correlated with attrition.[31] However, he concluded that the current system, which uses Education Tier and AFQT score to forecast attrition, is not sufficiently predictive. Furthermore, the nature of the Tier system, which aggregates all education credentials into just three groups, exacerbates the problem of predictability.[32] Among his other findings were that married recruits, recruits who had enlisted with no specified job specialty, and female recruits, in general, were all comparatively more likely to attrite.[33]

B.   EVOLUTION OF NAVY SCREENING TECHNIQUES

Eitelberg notes that, since the establishment of the AVF, the Armed Forces have been searching for "screening criteria flexible enough to bend with the frequently unknown effects of external factors while ensuring that qualitative and quantitative recruiting objectives could be accomplished."[34] Screening during World War II consisted of physical, mental, and emotional evaluations, as well as an

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[30] Huth, 36.

[31] Jon K. Neuhalfen, "Analysis of Recruit Attrition from the Navy's Delayed Entry Program and Recruit Training Command," (Master's thesis, Naval Postgraduate School, Monterey, CA, 2007), 135–139.

[32] Ibid., 200.

[33] Ibid., 199.

[34] Eitelberg et al., 2–9.

assessment of one's history of arrests. The military's simple goal then was to develop a screening mechanism that would allow the services to "accept those who would succeed in their assignments and to reject those who would fail."[35] This basic goal has changed little to this day; yet, as the military's missions, training, technology, and very nature have become far more complicated, so has the need for effective screening.

The AFQT was developed and implemented in 1950 in response to the military's desire for a uniform aptitude test that all components could use. Designed specifically as a screening tool, the AFQT was established to gauge a recruit's trainability and general usefulness, giving the services the ability to refuse enlistment to those who did not qualify through the test.[36] The Armed Services Vocational Aptitude Battery (ASVAB) was adopted service-wide in 1976 in response to a 1974 Department of Defense mandate that all services use a single test for both enlistment and job classification. The AFQT is now a composite of four ASVAB subtests and remains in use as a general screening device. Table 2 shows AFQT test score categories.

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[35] Eli Ginzberg et al., *The Ineffective Soldier; Lessons for Management and the Nation, Volume I: The Lost Divisions* (New York: Columbia University Press, 1959), 140.

[36] Eitelberg et al., 1-15.

Table 2.   AFQT Test Score Categories (From Commander, Navy
                        Recruiting Command)

AFQT Test Score	Test Score Category
99 – 93	I
92 – 65	II
64 – 50	IIIA
49 – 31	IIIB
30 – 21	IVA
20 – 16	IVB
15 – 10	IVC
9 – 1	V

Following a 1960 study of first-term attrition, the Navy Neuropsychiatric Research Unit developed an "Odds for Effectiveness" (OFE) table for screening out applicants on the basis of background factors that increased their likelihood of attriting.[37] This table utilized AFQT scores, years of education completed, number of suspensions/expulsions from school, and number of non-traffic arrests (later modified to eliminate the arrest variable due to difficulty obtaining court records).[38] The OFE table indicated an individual's percentage chance of successfully completing a first term of enlistment.

While developed and available for use since the early 1960s, the OFE table was not actually employed until fiscal year 1973. However, since the OFE approach had been based on data from 1960-61, it contained influences from draft-

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[37] Lockman, 55.

[38] Robert F. Lockman, Christopher Jehn, and William F. Shughart II, *Models for Estimating Premature Losses and Recruiting District Performance* (Arlington, VA: Center for Naval Analyses, 1976), 15.

induced enlistments that were by then no longer relevant.[39] Lockman argued that the onset of the AVF necessitated an updated screening model, which he developed in 1975.[40] This new model became known as the Success Chances of Recruits Entering the Navy (SCREEN) model, and was adopted by the Navy at the beginning of fiscal year 1977. As shown in Table 3, the original SCREEN considered an applicant's years of education completed, age, AFQT, race, and dependency status in a matrix that assigned probabilities of completing the first and second years of service.[41]

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[39] William A. Sands, "Enlisted Personnel Selection for the U.S. Navy." *Personnel Psychology* 31, no. 1 (1978), 64.

[40] Robert F. Lockman, *Chances of Surviving the First Year of Service: A New Technique for Use in Making Recruiting Policy and Screening Applicants for the Navy* (Arlington, VA: Center for Naval Analyses, 1975), 19.

[41] Robert F. Lockman, *Success Chances of Recruits Entering the Navy (SCREEN)* (Arlington, VA: Center for Naval Analyses, 1977), 1.

Table 3.   Chances of Surviving the First Year of Service
(From Lockman)[42]

		Majority					
	Years of Education:	>12	12	>12	12	<12	
MG	Age	No Dependents		Dependents		No Dependents	Deps
I	18 – 19	99	96	95	92	85	81
	17	97	94	93	90	83	79
	20+	96	92	92	89	81	78
II	18 – 19	94	91	90	87	80	76
	17	92	89	89	86	78	74
	20+	91	88	87	84	76	73
IIIU	18 – 19	91	88	87	84	77	73
	17	90	87	86	83	76	72
	20+	88	85	84	81	74	70
IIIL	18 – 19	86	83	82	79	72	68
	17	85	81	81	78	70	67
	20+	83	80	79	76	69	65
IV	18 – 19	81	78	77	74	67	63
	17	80	77	76	73	66	62
	20+	78	75	74	71	64	60

		Minority					
	Years of Education:	>12	12	>12	12	<12	
MG	Age	No Dependents		Dependents		No Dependents	Deps
I	18 – 19	98	95	98	95	88	84
	17	97	94	97	94	87	83
	20+	95	92	96	92	85	83
II	18 – 19	93	90	93	90	83	79
	17	92	90	92	90	82	78
	20+	90	87	90	87	80	76
IIIU	18 – 19	91	88	91	88	80	77
	17	89	86	89	86	79	75
	20+	88	85	88	85	77	73
IIIL	18 – 19	89	86	86	83	75	71
	17	88	85	84	81	74	70
	20+	86	83	82	79	72	68
IV	18 – 19	85	82	81	78	70	67
	17	83	80	79	76	69	65
	20+	81	78	78	75	67	63

[42] "Majority" and "Minority" refer to race/ethnicity; "MG" refers to "Mental Group," or AFQT category, where IIIU and IIIL are equivalent to the current IIIA and IIIB categories, respectively. Thus, in reading the table, a racial/ethnic minority who is 18-19 years old, has an AFQT score in "MG-I," and has no dependents, would have a probability of 88 percent of surviving the first year of service in the Navy.

Lockman revised the SCREEN model six months after its introduction, refining the statistical model, removing the race variable, and slightly adjusting the age and years of education variables (see Table 4).[43] In response to shifting demographics, he once again revised the model in 1980 (see Table 5).[44]

Table 4.   First Year Screen (rev. 5-77)(From Lockman and Gordon)[45]

		No dependents				Dependents			
		Years of education				Years of education			
AFQT	Age	Over 12	12	11	Under 11	Over 12	12	11	Under 11
95-100	18-19	96	95	90	89	94	93	87	84
	17	96	94	90	88	94	92	86	83
	20+	95	93	88	86	93	90	83	80
67-94	18-19	92	90	82	79	89	86	76	72
	17	92	89	81	78	88	84	74	70
	20+	90	87	78	74	86	82	70	66
50-66	18-19	91	88	79	76	87	83	72	78
	17	90	87	77	74	86	82	70	66
	20+	88	84	74	70	84	79	66	62
35-49	18-19	87	83	72	68	82	77	63	59
	17	86	81	70	66	81	75	61	57
	20+	83	78	66	62	78	71	57	52
21-34	18-19	85	80	68	64	79	73	59	55
	17	84	79	66	62	78	72	57	52
	20+	81	75	62	57	74	68	52	48

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[43] Robert F. Lockman and Patrice L. Gordon, *A Revised SCREEN Model for Recruit Selection and Recruitment Planning* (Arlington, VA: Center for Naval Analyses, 1977), 2.

[44] Robert F. Lockman and Philip M. Lurie, *A New Look at Success Chances of Recruits Entering the Navy (SCREEN)* (Alexandria, VA: Center for Naval Analyses, 1980), 8-9.

[45] As an example, in reading the table, a person who is 18-19 years old, with no dependents, with over 12 years of education, and an AFQT percentile score between 95 and 100 (note: AFQT scores are percentile ranges) would have a 96 percent probability of completing the first year of service in the Navy.

Table 5.   Success Chances for Recruits Entering the Navy
(SCREEN)(From Lockman and Lurie)[46]

Mental group	Age	12 or more	Diploma	11	GED	10 or less	LT HS
1	17-19	94	93	90	85	89	77
	20+	92	90	87	82	85	74
2	17-19	90	91	82	83	79	76
	20+	86	88	76	79	73	71
3U	17-19	88	88	78	80	75	73
	20+	83	84	73	75	70	67
3L	17-19	82	83	71	75	67	68
	20+	77	78	65	70	61	62
4	17-19	80	75	67	68	63	62
	20+	74	79	61	61	56	56

By the early 1980s, it had become clear that the proliferation of different types of education credentials was making it difficult for the military to categorize recruits by the usual three education classifications (high school graduate, GED, and non-high school graduate) available in SCREEN. Laurence and others pointed out this dilemma in the early 1980s,[47] and discussed the potential benefit of identifying predictors of success within each of

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[46] As an example, in reading the table, a person who is 17-19 years old, with a high school diploma, and an AFQT percentile score in the "3U" category would have an 88 percent probability of completing the first year of service in the Navy.

[47] See, for example, Janice H. Laurence, *Secondary Education Credentials: A Military Enlistment Policy Dilemma* (Alexandria, VA: Human Resources Research Organization, 1983), 40-41.

those three education groups.[48] With that among their objectives, the Human Resources Research Organization (HumRRO) developed the Educational and Biographical Information Survey (EBIS), which was administered to 34,000 military applicants and 40,000 new recruits in the spring of 1983.[49]

The problem of having so many different interpretations of educational credentials was also examined by Eitelberg et al. in a major study of enlistment screening for the Department of Defense.[50] Additionally, Franke sought to determine if education credentials could be divided easily into separate categories, using first-term attrition probabilities as a guide.[51] Subsequently, researchers at the Naval Postgraduate School recommended to the Office of the Secretary of Defense that three categories be used to divide existing credentials and that the three categories be called "tiers." The basis for differentiating between the categories was the historical likelihood of first-term attrition associated with each educational credential.[52]

In 1987, the Department of Defense implemented a three-tier classification system for education credentials, basing

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[48] Janice H. Laurence, *Education Standards for Military Enlistment and the Search for Successful Recruits* (Alexandria, VA: Human Resources Research Organization, 1984), 36.

[49] Barbara Means and Linda S. Perelman, *The Development of the Educational and Biographical Information Survey* (Alexandria, VA: Human Resources Research Organization, 1984), 28.

[50] Eitelberg et al.

[51] David B. Franke, "An Evaluation of Marine Corps Educational Credentials," (Master's thesis, Naval Postgraduate School, Monterey, CA, 1983).

[52] Memo from Professor Mark Eitelberg to Director, Accession Policy, Office of the Secretary of Defense, 1983. The term "tier" was chosen to differentiate it from AFQT "categories," which are used in reporting AFQT scores.

its development largely on the EBIS results and the long-established relationship between education level and successful completion of the first term of enlistment:[53]

- Tier I – High School Diploma Graduate (HSDG) – traditional high school graduates and equivalents (or higher);

- Tier II – High School Graduate (HSG) – alternative high school credentials (including General Educational Development (GED) certificates);

- Tier III – Non-High School Graduate (NHSG) – not currently attending high school or alternative education and holds neither a Tier I nor Tier II credential.

This "Tier" system is currently used in conjunction with AFQT categories as the primary determinant of basic eligibility for enlistment.

Problems within the Tier system have been evident for over a decade. In 1997, Laurence observed that attrition rates of Adult Education Diploma holders and those with one semester of college, classified as Tier I credential holders, were more consistent with the attrition rates of persons holding Tier II credentials. She recommended that these credentials be re-categorized to account for the higher attrition rates.[54] Laurence notes that some alternative credentials are problematic because the groups

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[53] *Population Representation in the Military Services: Fiscal Year 2002* (Arlington, VA: Office of the Undersecretary of Defense, Personnel and Readiness, 2004), 2-3.

[54] Janice H. Laurence, Peter F. Ramsberger, and Jane M. Arabian, *Education Credential Tier Evaluation* (Alexandria, VA: Human Resources Research Organization, 1997), 12.

that issue these credentials are in the business of "trying to make their credentials indistinguishable from those issued to traditional high school graduates."[55] She also recommends that the "some college" classification be separated into those who have attended traditional college and those who have received their credits through vocational programs.[56] More recently, Neuhalfen and Flyer both came to similar conclusions concerning the attrition rates of adult education graduates and persons classified as having "some college."[57],[58]

Research by Bownds on the relationship between education credential, AFQT score, and attrition, resulted in a recommendation to revise the Navy's Recruit Quality Matrix. Bownds argues that, by using more education credentials and incremental AFQT scores, rather than the established education Tier system and AFQT categories, the Navy could more accurately predict the probability of a recruit completing the first term of enlistment.[59] Neuhalfen similarly concluded that the original Recruit Quality Matrix (see Figure 1) should be updated (see Figure 2, below) and re-implemented, noting that the Tier system does not accurately account for differences between individual education credentials and their associated likelihood of attrition.[60]

[55] Laurence et al., 14.

[56] Ibid., 28.

[57] Neuhalfen, 200.

[58] Eli S. Flyer, "Development of an Enlistment Screening Measure for Navy Recruits," 2008.

[59] Bownds, 53.

[60] Neuhalfen, 202.
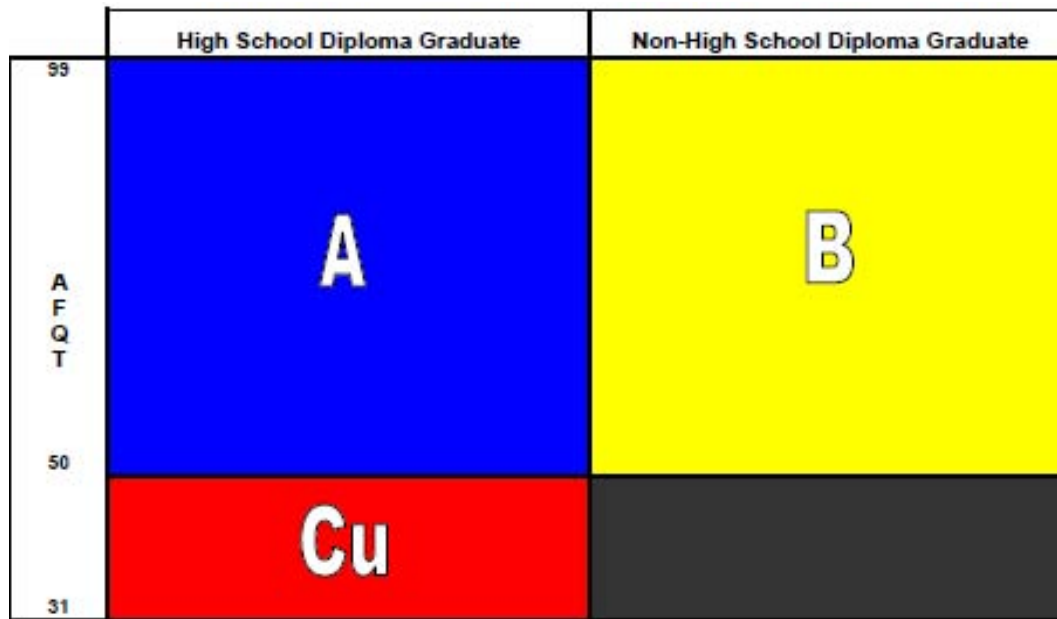
Figure 1.   Navy Recruit Quality Matrix (From Bownds)
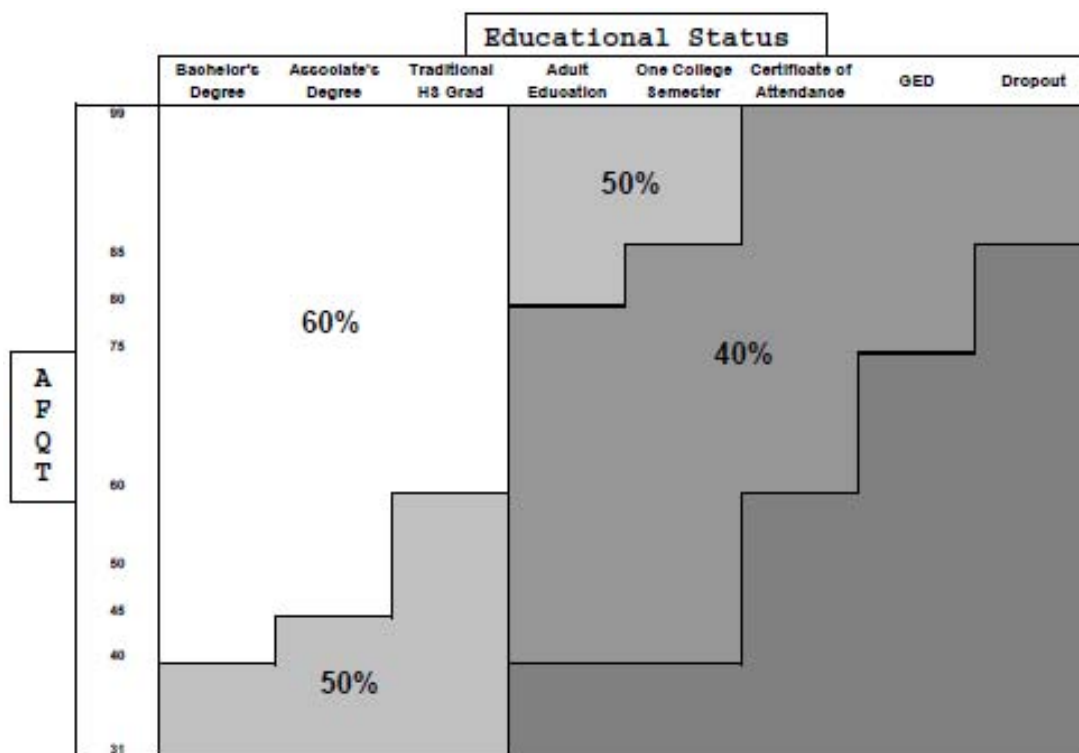
Figure 2.   Predicted Probability of First-Term Completion by AFQT Score and Educational Status (From Bownds)

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In 2008, Flyer, who has been studying attrition since the 1950s (as discussed above), argued that using the Tier system is no longer effective in reducing attrition. Flyer recommended developing attrition probability tables that applied weights to the education credential and AFQT score, but which also would include other attrition predictors such as age and gender.[61]

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[61] Flyer, 2008.

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III. ANALYSIS OF NAVY FIRST-TERM ATTRITION

First-term attrition is an established measure of performance for enlisted personnel in the All-Volunteer Force. For those who complete their enlistment, the Navy has received the desired return on its investment. For each Sailor who attrites before completing a first term of enlistment, the Navy has not realized a full return on its investment of training, time, equipment, and other related expenses. In addition, recruiting goals must be set at a higher level to replace those who attrite. The average cost to recruit an individual Sailor was approximately $15,000 in fiscal year 2008.[62] Add recruit salaries, transportation, training expenditures, and other expenses to that, and it is easy to see how the cost of attrition quickly adds up to a staggering amount.[63]

The cost of attrition increases as an enlistee accrues more and more training, up to a point. Attrition that occurs during initial training at Recruit Training Command (RTC), commonly known as boot camp, is generally than attrition once Sailors have moved beyond initial training. Bownds and Neuhalfen both assert that one can extrapolate first-term attrition trends from analysis of boot camp attrition.[64],[65] However, Buddin noted in 1984 that "factors

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[62] Noble.

[63] In 1998, GAO estimated that the average cost of training each enlistee was $28,000. The true cost of losing a recruit through first-term attrition would need to account for any return on the investment (time served) as well as the administrative costs of separation. Thus, the cost range could be anywhere from $15,000 (early loss of recruit) to over $100,000 (early loss after occupational training) for each Navy recruit who separates prematurely.

[64] Bownds, 15.

influencing attrition behavior during the initial training period may differ substantially from factors influencing later (post-training) attrition."[66] Also, Putka demonstrated in 2005 that the character of attrition varies by month of service.[67] Although Putka's research was restricted to the Army, it is reasonable to assume that similar differences in attrition occur over time in each service. This chapter evaluates first-term attrition over the course of the entire first term of enlistment. Then, the following chapter examines first-term attrition of the subset of recruits who complete initial training.[68]

A.   DATA

The dataset used for this research was constructed using DMDC's Enlisted Cohort File, which in turn was created from the Military Entrance Processing Command (MEPCOM) Accession database. The dataset contains the records of all recruits who enlisted with a four-year contract from fiscal years 1999 through 2003, a span of time that ensures sufficient sample sizes of all applicable demographic, education, and aptitude variables. Fiscal year 2003 is the most recent cohort to have completed an entire first term of enlistment for which data were available at the time of this study.

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[65] Neuhalfen, 135.

[66] Buddin, 1.

[67] Daniel J. Putka and William J. Strickland, *A Comparison of the FY03 and FY99 First Term Attrition Study Cohorts* (Alexandria, VA: Human Resources Research Organization, 2005).

[68] For a comprehensive analysis of boot camp attrition, see Bownds.

The original source dataset contains 234,348 observations. Only persons who entered service as an E-1 through E-3 were analyzed, and observations with missing or unreliable data were deleted. Individuals who separated early from the Navy with various non-negative Interservice Separation Codes (ISCs), such as selection for an officer program, death/disability, etc., were not considered "attrites" for the purpose of this research and were deleted. These restrictions resulted in a dataset with 218,707 observations for the comprehensive analysis. The dataset was further restricted where noted for more detailed analyses of various demographic groups. Stata software was used to process and analyze the data.

B.   METHODOLOGY

The five years of enlisted cohort data were used to analyze attrition patterns of various groups by education credential, race, gender, AFQT score, marital status, dependency status, and age. Attrition status was determined by comparing accession date with separation date. An "attrite" was defined as any individual who separated more than 90 days prior to the completion of four years of service.[69]

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[69] Sailors may separate, upon approved request, up to 90 days before the end of their enlistment to pursue educational opportunities, in accordance with MILPERSMAN 1910, Enlisted Administrative Separations (ADSEP). Any person who separated within 90 days of completing four years of service was therefore not considered to have attrited for the purposes of this study.

C.   VARIABLES

Education credential and AFQT score are the two variables of primary interest, since these are the two main determining factors of eligibility used by Commander, Navy Recruiting Command (CNRC). Twenty-two education credentials are present in the original dataset. Individuals with three of these, codes "9," "M," and "S," were removed from the sample because these codes reflect current participation in an education program and are intended to be changed prior to commencement of active duty to reflect ultimate education status (i.e., one cannot be a recruit at Recruit Training Command and simultaneously be an 11S-coded enrolled high school senior). While only nine of the remaining 19 variables are present in sufficient numbers for meaningful statistical analysis, all 19 variables were included in the dataset as part of the overall Tier analysis and to improve model specification. The data include 11 Tier I variables: ed_8, ed_B, ed_D, ed_F, ed_G, ed_K, ed_L, ed_N, ed_R, ed_U, and ed_W. Tier II consists of seven variables: ed_5, ed_7, ed_C, ed_E, ed_H, ed_J, and ed_X. Tier III consists of only one variable, ed_1. Table 6 presents a detailed description of each education variable and the tier to which it is assigned. Table 9 (below) presents descriptive statistics of each education credential variable.

Table 6.   Education Credentials (After Commander, Navy Recruiting Command)

Variable	Code	Tier	Variable Name	Variable Description
Non-HS Grad	1	III	ed_1	Not currently attending HS or alternative education and hold neither a Tier I or Tier II credential
Other non-traditional	5	II	ed_5	Credential issued for completing alternative school that differs in curriculum from traditional HS program
Correspondence school diploma	7	II	ed_7	Diploma or certificate awarded upon completion of correspondence school, distance learning, or independent study
15 college creds or Job Corps + GED	8	I	ed_8	Completion of 15 semester credits, 22 quarter credits, or 675 clock hours of instruction from an accredited post-secondary institution. Alternately, earning a GED while completing Job Corps program
Probationary HS senior	9*	I	ed_9	HS seniors enrolled in Tier I program that have not completed at least 70% of credits required to graduate
Adult/ alternate HS diploma grad	B	I	ed_B	Diploma awarded on the basis of completing an alternative, continuation, adult, or charter program whose curriculum satisfies grad requirements of traditional HS
Occupational program certificate/ diploma	C	II	ed_C	Certificate/diploma for non-correspondence vocational, technical, or proprietary secondary school program, plus completion of at least 11 years of traditional school
Associate's degree	D	I	ed_D	Postsecondary degree – Associate's
GED	E	II	ed_E	Test-based equivalency

				diploma, certificate of General Education Development (GED)
HS diploma but failed exit exam	F	I	ed_F	Completed all necessary credits for graduation but did not pass state mandated exit exam(s)
Nursing degree	G	I	ed_G	Postsecondary degree in nursing
Home schooled	H	II	ed_H	Home school diploma from parent or home school association
Attendance based HS diploma	J	II	ed_J	HS certificate of attendance or completion – based on course completion rather than on a test such as GED
Bachelor's degree	K	I	ed_K	Postsecondary degree – Bachelor's
HS diploma grad	L	I	ed_L	Traditional HS diploma graduate
Enrolled in other than HS program	M*	I	ed_M	Attending class in a Tier I category other than traditional HS (college, Job Corps, etc.)
Master's degree	N	I	ed_N	Postsecondary degree – Master's
Post-baccalaureate	R	I	ed_R	Education beyond Bachelor's degree
Traditional HS senior	S*	I	ed_S	HS students who have completed junior year and earned at least 70% or required grad credits
Post-baccalaureate	U	I	ed_U	Education beyond Bachelor's degree
Post-baccalaureate	W	I	ed_W	Education beyond Bachelor's degree
Nat'l Guard Youth Challenge	X	II	ed_X	National Guard Youth Challenge Program/ Seaborne Challenge Corps cert of completion + GED

* Education codes 9, M, and S indicate the recruit is enrolled in a program. These individuals should be re-coded prior to accession to indicate failure or completion of their program. For example, an 11S high school senior who graduates would be re-coded as a 12L.

Other variables were included to improve model specification, as well as to analyze the effect of various demographic factors on attrition probability. These

variables include gender, marital status, dependency status, age, and race. Table 9 (below) describes these variables and shows the standard statistical properties of each.

D. RESULTS

This section presents the results of first-term attrition analysis by AFQT scores and education credentials (by both Tier classification and individually).

1. Attrition by Educational Tier

This analysis examines the differences in attrition among each of the three educational Tiers. As Table 7 shows, attrition for Sailors holding Tier I education credentials is considerably lower than for those classified as Tier II or Tier III, and this is to be expected. At the same time, it is somewhat surprising that attrition rates are roughly the same between Tier II and Tier III from year to year, if not somewhat lower for Tier III.[70] Table 7 also shows a declining attrition rate among both Tier II and Tier III. Table 8 shows a corresponding declining accession rate for both Tier II and Tier III, which implies that greater scrutiny was given to applicants with these credentials and fewer "high-risk" individuals were allowed to enlist.

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[70] Nearly 15 percent of Tier II recruits in the dataset have an AFQT below 50, while less than 2 percent of Tier III recruits scored below 50. This implies that the Navy Enlisted Recruiting Manual requirement of a minimum AFQT score of 50 for these recruits was not as strictly adhered to for Tier II individuals. More Tier II recruits with lower AFQT scores may partially explain why the Tier II attrition rate is higher than expected.

Table 7.   Navy First-Term Attrition by Educational Tier, Fiscal Years 1999 through 2003 (After DMDC, 2009)

Variable	N	Attrition Rate (%)	FY99 (%)	FY00 (%)	FY01 (%)	FY02 (%)	FY03 (%)
Tier I	197,278	31.1	31.8	31.1	32.4	29.3	30.6
Tier II	14,032	51.4	53.5	52.8	52.6	48.6	45.1
Tier III	7,397	50.4	50.2	53.1	52.3	48.4	41.9
Total	**218,707**	**33.1**	**34.2**	**33.5**	**34.5**	**31.0**	**31.4**

Table 8.   Navy Enlisted Accessions by Educational Tier, Fiscal Years 1999 through 2003 (After DMDC, 2009)

Variable	Total	FY99	FY00	FY01	FY02	FY03
Tier I	197,278	42,339	40,734	41,395	37,278	35,532
Tier II	14,032	3,804	3,173	3,176	2,289	1,590
Tier III	7,397	1,720	1,863	1,835	1,259	720
Total	**218,707**	**47,863**	**45,770**	**46,406**	**40,826**	**37,842**

Using Maximum Likelihood Estimation (MLE), a probit model was used (with marginal effects computed) to analyze the data and to test for statistical significance. Based on research discussed in Chapter II, variables identified as having potential effects on attrition were included in the model specified below. Fiscal year dummy variables were included to improve model specification. The base for the model was an "average recruit," specifically, a Tier I, single, white, 20-year-old male with no dependents, with an AFQT score of 59, and who entered the Navy on active duty in fiscal year 1999. Variables are described in Table 9, as shown below.

$$\text{Attrite} = B0 + B1(\text{afqt}) + B2(\text{female}) + B3(\text{sngwdep}) +$$
$$B4(\text{marriednokids}) + B5(\text{marriedwkids}) + B6(\text{age}) + B7(\text{black}) +$$
$$B8(\text{hisp}) + B9(\text{apina}) + B10(\text{othrace}) + B11(\text{tier2}) +$$
$$B12(\text{tier3}) + B13(\text{fy00}) + B14(\text{fy01}) + B15(\text{fy02}) + B16(\text{fy03}) +$$
$$\mu.$$

Table 9.   Variable Descriptions and Descriptive Statistics (After DMDC, 2009)

Variable	Description	Mean	Std Dev	Min	Max
attrite	= 1 if "attrited" during first term, 0 otherwise	0.3305	0.0010	0	1
afqt	AFQT percentile (31-99)	58.63	0.0396	31	99
female	= 1 if Female, 0 otherwise	0.1758	0.0008	0	1
sngwdep	= 1 if marital status "Single" and dependents>0, 0 otherwise	0.0475	0.0005	0	1
marriednokids	= 1 if marital status "Married" and dependents<=1, 0 otherwise	0.0240	0.0003	0	1
marriedwkids	= 1 if marital status "Married" and dependents>1, 0 otherwise	0.0318	0.0004	0	1
age	= Age in years (17-34)	19.87	0.0059	17	34
black	= 1 if Black, 0 otherwise	0.1979	0.0009	0	1
hisp	= 1 if Hispanic, 0 otherwise	0.1234	0.0007	0	1
apina	= 1 if Asian, Pacific Islander, or Native American, 0 otherwise	0.0861	0.0006	0	1
othrace	= 1 if race "other", 0 otherwise	0.0106	0.0002	0	1
tier2	= 1 if Tier II, 0 otherwise	0.0642	0.0005	0	1
tier3	= 1 if Tier III, 0 otherwise	0.0338	0.0003	0	1
fy00	= 1 if FY00 accession, 0 otherwise	0.2093	0.0009	0	1
fy01	= 1 if FY01 accession, 0 otherwise	0.2122	0.0009	0	1
fy02	= 1 if FY02 accession, 0 otherwise	0.1867	0.0008	0	1
fy03	= 1 if FY03 accession, 0 otherwise	0.1730	0.0008	0	1

In this section, two models were constructed to analyze first-term attrition. The first is as specified above; the second replaces the "tier2" and "tier3" variables with each individual education credential broken out, including Tier I credentials, as described in Table 6 and Table 10. For the second model, the "average recruit" remains the same, with the exception of holding a specific education credential of "L" rather than just "Tier I."

Table 10.   Descriptive Statistics of Education Credentials
(After DMDC, 2009)

Variable	Description	Mean	Std Dev	Min	Max
ed_1	= 1 if educ credential "1", 0 otherwise	0.0338	0.0004	0	1
ed_5	= 1 if educ credential "5", 0 otherwise	0.00003	0.00001	0	1
ed_7	= 1 if educ credential "7", 0 otherwise	0.0006	0.00005	0	1
ed_8	= 1 if educ credential "8", 0 otherwise	0.0297	0.0004	0	1
ed_B	= 1 if educ credential "B", 0 otherwise	0.0287	0.0004	0	1
ed_C	= 1 if educ credential "C", 0 otherwise	0.0001	0.00002	0	1
ed_D	= 1 if educ credential "D", 0 otherwise	0.0072	0.0002	0	1
ed_E	= 1 if educ credential "E", 0 otherwise	0.0495	0.0005	0	1
ed_F	= 1 if educ credential "F", 0 otherwise	0.0010	0.00007	0	1
ed_G	= 1 if educ credential "G", 0 otherwise	0.00005	0.00001	0	1
ed_H	= 1 if educ credential "H", 0 otherwise	0.0083	0.0002	0	1
ed_J	= 1 if educ credential "J", 0 otherwise	0.0006	0.00005	0	1
ed_K	= 1 if educ credential "K", 0 otherwise	0.0113	0.0002	0	1
ed_N	= 1 if educ credential "N", 0 otherwise	0.0004	0.00004	0	1
ed_R	= 1 if educ credential "R", 0 otherwise	0.00007	0.00002	0	1
ed_U	= 1 if educ credential "U", 0 otherwise	0.00002	0.00000	0	1
ed_W	= 1 if educ credential "W", 0 otherwise	0.00003	0.00001	0	1
ed_X	= 1 if educ credential "X", 0 otherwise	0.0050	0.0002	0	1

The regression result for the model using only educational Tiers, presented in Table 11, shows that, all other factors held constant, being female, being single with dependents, or being married, results in a higher probability of attrition. Being a member of any race other that White results in a lower attrition probability.

The estimates of the independent variables primarily used by the Navy to determine enlistment eligibility (AFQT score and educational Tier) were significant and as predicted. That is, as AFQT score increased, the probability of attrition decreased, an observation that has been found in numerous previous studies (see Chapter II). Tier II and Tier III individuals had a significantly higher likelihood of attrition than did Tier I recruits. While this is in line with the intent of the Tier system, it is interesting to observe that the marginal effects of holding a Tier II credential are roughly the same as for being classified as Tier III. Both indicate a likelihood of attrition 20 percentage points higher than Tier I. In other words, an individual who holds a Tier II education credential is no less likely to attrite than is an individual who is a Tier III high school dropout.

The Navy uses dependency status as a secondary enlistment screening mechanism.[71] However, despite such a screening method being in place, single recruits who have dependent children are much more likely to attrite than are married recruits with or without children. This implies

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[71] Commander, Navy Recruiting Command, 2-5-1.

that the current dependency screening method is ineffective at culling out applicants who present a greater risk of attriting.

Table 11.   Probit Regression Results using Educational Tiers (After DMDC, 2009)

Variable	Coef.	Std Err	z	P>|z|	dF/dx	Mean
afqt	−0.00630***	0.000161	−39.01	0.000	−0.00227***	58.634
female	0.0710***	0.00737	9.63	0.000	0.0259***	0.176
sngwdep	0.179***	0.0133	13.50	0.000	0.0669***	0.048
marriednokids	−0.00675	0.0187	−0.36	0.718	−0.00243	0.024
marriedwkids	0.0395**	0.0165	2.39	0.017	0.0144**	0.032
age	0.00451***	0.00109	4.13	0.000	0.00163***	19.872
black	−0.107***	0.00762	−14.05	0.000	−0.0380***	0.198
hisp	−0.266***	0.00912	−29.11	0.000	−0.0910***	0.123
apina	−0.211***	0.0105	−20.15	0.000	−0.0729***	0.086
othrace	−0.178***	0.0278	−6.41	0.000	−0.0616***	0.011
tier2	0.526***	0.0111	47.32	0.000	0.203***	0.064
tier3	0.519***	0.0150	34.64	0.092	0.201***	0.034
fy00	−0.0144*	0.00854	−1.69	0.092	−0.00519*	0.209
fy01	0.0143*	0.00849	1.69	0.000	0.00518*	0.212
fy02	−0.0708***	0.00886	−7.99	0.000	−0.0253***	0.187
fy03	−0.0321***	0.00905	−3.55	0.000	−0.0115***	0.173
Constant	−0.149***	0.0238	−6.25	0.000		
Observations	218707					
Pseudo R-squared	0.0219					

*** p<0.01, ** p<0.05, * p<0.1

2.   Attrition by Education Credential

Using individual education credentials in the model, rather than Tiers, improves the "goodness-of-fit" pseudo R-squared from 0.0219 to 0.0261.   Table 12 shows that the second regression resulted in only minor differences in variable coefficients.   However, with the education codes broken out, one can begin to see how credentials within each Tier vary relative to predicted attrition.   In the first model, Tier II and Tier III both indicate a similar likelihood of attrition.   Yet, in the second model, one sees

that the Tier III code "1" high school dropout is no more likely to attrite than is the Tier II code "E" holder of a General Educational Development (GED) certificate. At the same time, the Tier II code "X" National Guard Youth Challenge GED holder is 27.2 percentage points more likely to attrite than an otherwise similar Tier I code "L" traditional high school graduate.

As expected, the codes for recruits with associate's, bachelor's, and master's degrees, "D," "K," and "N," respectively, indicate increasingly lower odds to attrite.[72] Surprisingly, Tier I codes "8" and "B" (some college and adult education diploma, respectively) have a likelihood of attrition that is both statistically significant and considerably higher than that of a traditional high school graduate.

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[72] Coefficients for post-baccalaureate educational codes "R," "U," and "W" are inconclusive, likely due to insufficient sample size.

Probit Regression Results using Individual Education Credentials (After DMDC, 2009)

Variable	Coef.	Std Err	z	P>|z|	dF/dx	Mean
afqt	-0.00575***	0.000163	-35.20	0.000	-0.00207***	58.634
female	0.0799***	0.00739	10.81	0.000	0.0291***	0.176
sngwdep	0.161***	0.0133	12.11	0.000	0.0600***	0.048
marriednokids	-0.0124	0.0188	-0.66	0.508	-0.00447	0.024
marriedwkids	0.0211	0.0166	1.27	0.204	0.00763	0.032
age	0.00459***	0.00114	4.02	0.000	0.00166***	19.872
black	-0.102***	0.00764	-13.31	0.000	-0.0362***	0.198
hisp	-0.266***	0.00914	-29.13	0.000	-0.0912***	0.123
apina	-0.213***	0.0105	-20.24	0.000	-0.0733***	0.086
othrace	-0.175***	0.0278	-6.29	0.000	-0.0605***	0.011
ed_1	0.542***	0.0150	36.11	0.000	0.210***	0.034
ed_5	0.00261	0.505	0.01	0.000	0.000942	0.000
ed_7	0.510***	0.114	4.46	0.000	0.198***	0.001
ed_8	0.417***	0.0161	25.91	0.000	0.160***	0.030
ed_B	0.329***	0.0163	20.16	0.000	0.125***	0.029
ed_C	0.316	0.253	1.25	0.211	0.120	0.000
ed_D	-0.125***	0.0352	-3.55	0.000	-0.0436***	0.007
ed_E	0.544***	0.0126	43.14	0.000	0.210***	0.050
ed_F	0.125	0.0890	1.41	0.159	0.0464	0.001
ed_G	0.295	0.402	0.73	0.463	0.112	0.000
ed_H	0.533***	0.0298	17.89	0.000	0.207***	0.008
ed_J	0.152	0.114	1.33	0.183	0.0567	0.001
ed_K	-0.196***	0.0294	-6.67	0.000	-0.0674***	0.011
ed_N	-0.255	0.161	-1.58	0.113	-0.0859*	0.000
ed_R	0.420	0.322	1.30	0.193	0.162	0.000
ed_W	0.368	0.477	0.77	0.441	0.141	0.000
ed_X	0.699***	0.0386	18.12	0.000	0.272***	0.005
fy00	-0.0155*	0.00857	-1.81	0.071	-0.00557*	0.209
fy01	0.0115	0.00852	1.35	0.177	0.00415	0.212
fy02	-0.0742***	0.00890	-8.34	0.000	-0.0265***	0.187
fy03	-0.0298***	0.00909	-3.27	0.001	-0.0107***	0.173
Constant	-0.205***	0.0248				
Observations	218707					
Pseudo R-squared	0.0261					

*** p<0.01, ** p<0.05, * p<0.1

3. Summary of Results

A logical assumption is that Tier II should be composed of education credentials that have a likelihood of attrition somewhere between the credentials assigned to Tier I and Tier III, namely, an attrition likelihood higher than that of a high school graduate and lower than that of a high

school dropout. However, as both Table 12 and Table 13 illustrate, this is not necessarily the case. While progress in this regard has been made in the past few years, with Home School and National Guard Youth Challenge credentials being moved from Tier I to Tier II, too much variation remains in attrition rates among the assorted education credentials for the Tier system to be as effective as possible. The analysis supports the conclusion that the Navy's screening model would have better predictive ability and would thus be more effective at reducing first-term attrition if individual education credentials were taken into account rather than using the current three-tier Tier system.

Table 12.   First-Term Attrition Rates (Percent) by Selected Education Credentials, Fiscal Years 1999 through 2003 (After DMDC, 2009)

Credential (Tier)	Number in Dataset	Attrition Rate (%)
Dropout (III)	7,397	50.4
Nat'l Guard Youth Challenge (II)	1,095	59.5
Home School (II)	1,824	53.2
GED (II)	10,832	50.5
Some College (I)	6,495	47.3
Adult Ed (I)	6,279	43.5
HS Grad (I)	180,138	30.3
Associate's (I)	1,564	25.0
Bachelor's (I)	2,479	21.5

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IV. ANALYSIS OF NAVY FIRST-TERM ATTRITION: SURVIVORS OF INITIAL TRAINING

As noted in Chapter III, evidence suggests that attrition during initial training differs from that which occurs later. Figure 3 shows that attrition during the first 90 days of service in the Navy declined steadily over the five-year period analyzed. This was likely the result of targeted efforts to reduce attrition at RTC as well as better preparation of recruits for boot camp during the Delayed Entry Program (DEP). Meanwhile, Figure 4 (below) shows that the first-term attrition rates of those who had successfully completed initial training rose during the same time period.

Fleet attrition costs the Navy more monetarily due largely to the occupational training invested in recruits who have moved beyond bootcamp. Not only that, but once a Sailor has reported to a ship, squadron, or shore station, the loss of that individual means reduced readiness in that command until a replacement arrives and acclimates. Since attrition from initial training has fallen to more "acceptable" levels and fleet attrition appears to be rising, research should focus directly on the latter. With that end in mind, this study now considers the attrition trends of Sailors who have successfully completed the first 90 days of service (henceforth called "survivors").
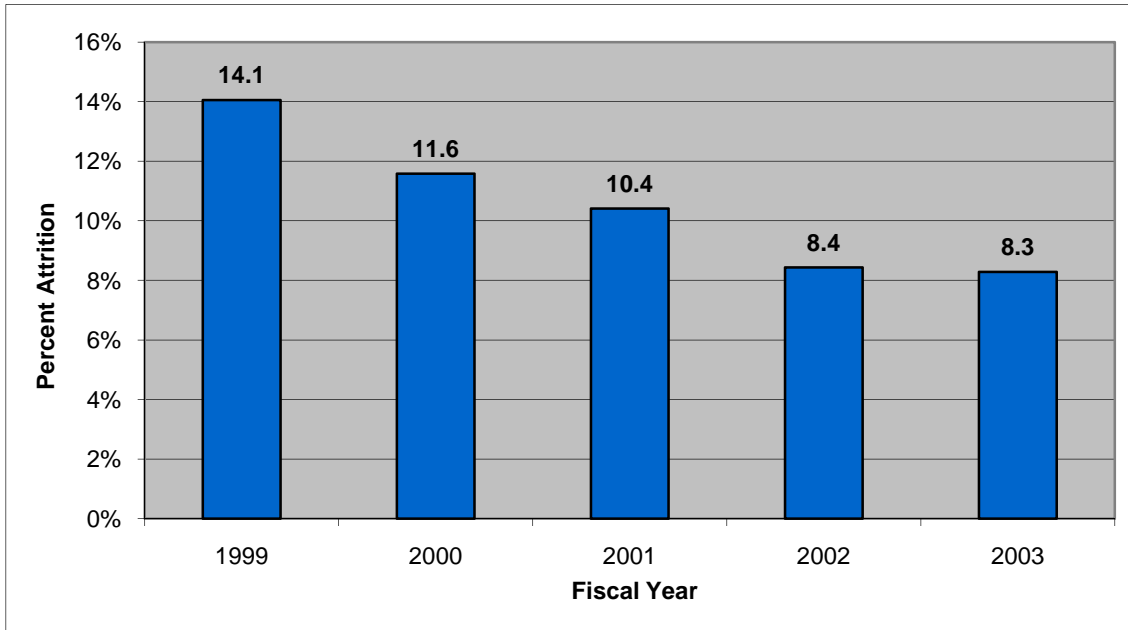
Figure 3.   Initial Training Attrition Rates (Percent),
Fiscal Years 1999 through 2003 (After DMDC, 2009)
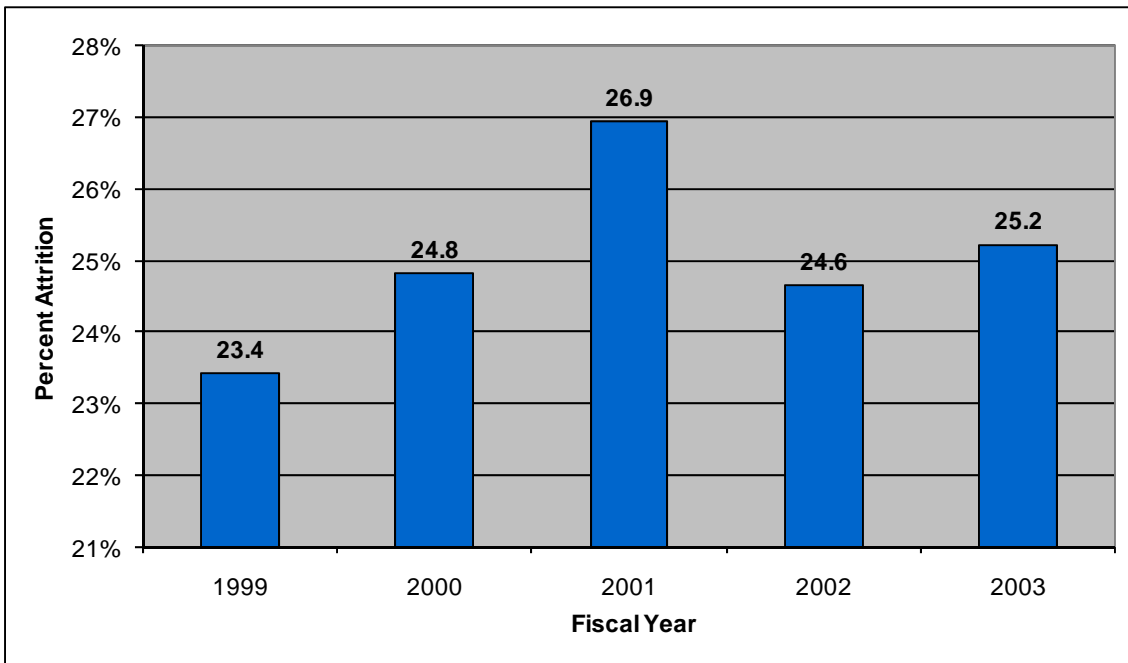
Figure 4.   First-Term Attrition Rates (Percent),
Survivors of Initial Training, Fiscal Years 1999
through 2003 (After DMDC, 2009)

A. DATA

The dataset used for this research was constructed using the same DMDC Enlisted Cohort File as used in the Chapter III analysis. In addition to the restrictions placed on the data in the comprehensive analysis of first-term attrition, the records of all individuals who left the Navy with less than 90 days of service were deleted.[73] This restriction resulted in a dataset with 195,286 observations that comprised the dataset for the analysis of survivors. The dataset was further restricted where noted for more detailed analyses of various demographic groups. Stata software was employed to process and analyze the data.

B. METHODOLOGY

Five years of enlisted cohort data were used in an identical manner as in Chapter III to analyze attrition patterns of various groups by education credential, race, gender, AFQT score, marital status, dependency status, and age. Results of the survivor analysis were compared with the results of the comprehensive analysis to determine what differences, if any, exist between the survivor group and those who attrited before completing 90 days of service.

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[73] Navy bootcamp is approximately 63 days in duration. After this, Sailors take leave and/or move on to more advanced training. Ninety days was selected as a cutoff for when an individual is considered to have progressed from being a "recruit" in initial training, to a "Sailor" who has successfully adjusted to the structure of military life and is receiving specialized training or has moved on to a permanent command.

C.   VARIABLES

Description of the variables used in the attrition analysis of initial training survivors is identical to those used in the analysis of initial training attrition. Nine of the 19 education variables included are present in sufficient numbers for meaningful statistical analysis, but all 19 variables were included in the dataset as part of the overall Tier analysis and to improve model specification. The data include 11 Tier I variables: ed_8, ed_B, ed_D, ed_F, ed_G, ed_K, ed_L, ed_N, ed_R, ed_U, and ed_W. Tier II consists of seven variables: ed_5, ed_7, ed_C, ed_E, ed_H, ed_J, and ed_X. Tier III consists of only one variable, ed_1. Refer to Table 6 for a detailed description of each education variable and the tier to which it is assigned. Table 14 shows descriptive statistics for each education credential variable, updated for the survivor sample.

Table 13.   Descriptive Statistics of Education Credentials, Survivor Sample (After DMDC, 2009)

Variable	Description	Mean	Std Dev	Min	Max
ed_1	= 1 if educ credential "1", 0 otherwise	0.0312	0.0004	0	1
ed_5	= 1 if educ credential "5", 0 otherwise	0.00003	0.00001	0	1
ed_7	= 1 if educ credential "7", 0 otherwise	0.0005	0.00005	0	1
ed_8	= 1 if educ credential "8", 0 otherwise	0.0285	0.0004	0	1
ed_B	= 1 if educ credential "B", 0 otherwise	0.0275	0.0004	0	1
ed_C	= 1 if educ credential "C", 0 otherwise	0.0001	0.00002	0	1
ed_D	= 1 if educ credential "D", 0 otherwise	0.0072	0.0002	0	1
ed_E	= 1 if educ credential "E", 0 otherwise	0.0454	0.0005	0	1
ed_F	= 1 if educ credential "F", 0 otherwise	0.0010	0.00007	0	1
ed_G	= 1 if educ credential "G", 0 otherwise	0.00004	0.00001	0	1
ed_H	= 1 if educ credential "H", 0 otherwise	0.0075	0.0002	0	1
ed_J	= 1 if educ credential "J", 0 otherwise	0.0006	0.00006	0	1
ed_K	= 1 if educ credential "K", 0 otherwise	0.0118	0.0002	0	1
ed_N	= 1 if educ credential "N", 0 otherwise	0.0004	0.00004	0	1
ed_R	= 1 if educ credential "R", 0 otherwise	0.00005	0.00002	0	1
ed_U	= 1 if educ credential "U", 0 otherwise	0.00002	0.00001	0	1
ed_W	= 1 if educ credential "W", 0 otherwise	0.00003	0.00001	0	1
ed_X	= 1 if educ credential "X", 0 otherwise	0.0048	0.0002	0	1

Other variables were included to improve model specification, as well as to analyze the effect of various demographic factors on attrition probability. These variables include gender, marital status, dependency status, age, and race. Table 15 describes these variables and shows the standard statistical properties of each, updated for the survivor sample.

Table 14.   Variable Descriptions and Descriptive
Statistics, Survivor Sample (After DMDC, 2009)

Variable	Description	Mean	Std Dev	Min	Max
attrite	= 1 if "attrited" during first term, 0 otherwise	0.2501	0.0010	0	1
afqt	AFQT percentile (31-99)	58.93	0.0421	31	99
female	= 1 if Female, 0 otherwise	0.1725	0.0009	0	1
sngwdep	= 1 if marital status "Single" and dependents>0	0.0454	0.0005	0	1
marriednokids	= 1 if marital status "Married" and dependents<=1	0.0233	0.0003	0	1
marriedwkids	= 1 if marital status "Married" and dependents>1	0.0305	0.0004	0	1
age	= Age in years (17-34)	19.84	0.0062	17	34
black	= 1 if Black, 0 otherwise	0.1997	0.0009	0	1
hisp	= 1 if Hispanic, 0 otherwise	0.1271	0.0008	0	1
apina	= 1 if Asian, Pacific Islander, or Native American, 0 otherwise	0.0877	0.0006	0	1
othrace	= 1 if race "other", 0 otherwise	0.0108	0.0002	0	1
tier2	= 1 if Tier II, 0 otherwise	0.0589	0.0005	0	1
tier3	= 1 if Tier III, 0 otherwise	0.0312	0.0004	0	1
fy00	= 1 if FY00 accession, 0 otherwise	0.2072	0.0009	0	1
fy01	= 1 if FY01 accession, 0 otherwise	0.2129	0.0009	0	1
fy02	= 1 if FY02 accession, 0 otherwise	0.1914	0.0009	0	1
fy03	= 1 if FY03 accession, 0 otherwise	0.1777	0.0009	0	1

D.   RESULTS

This section presents the results of first-term attrition analysis of the survivor sample by AFQT scores and education credentials (according to Tier classification and individually).

1.   Attrition by Educational Tier

This analysis examines the differences in attrition between each of the three Educational Tiers. As Table 16 shows, first-term attrition of survivors of initial training follows a familiar pattern, with Tier I Sailors having a significantly lower attrition rate than those classified as Tier II or Tier III. Also similar to the analysis in Chapter III, Tier II and Tier III attrition rates are roughly the same for the survivor sample. However, Table 16 fails to display the steadily declining attrition rates among Tier II and Tier III survivors of initial training that was apparent in the sample that included initial training attrites (see Table 7). Observing initial training attrition rates, as shown in Figure 5, it can be seen that attrition from initial training by Tier II and Tier III recruits has declined steadily. At the same time, since the first-term attrition rates of survivors in those Tiers have remained relatively stable over the same period, there is no cause to conclude that RTC may have lowered its attrition rates by passing along problem recruits to the fleet.

Table 15.   Navy First-Term Attrition by Educational Tier, Survivor Sample, Fiscal Years 1999 through 2003 (After DMDC, 2009)

Variable	N	Attrition Rate (%)	FY99 (%)	FY00 (%)	FY01 (%)	FY02 (%)	FY03 (%)
Tier I	177,674	23.5	21.7	22.9	25.2	23.2	24.5
Tier II	11,496	40.7	39.4	41.4	42.9	40.4	38.1
Tier III	6,098	39.8	36.0	41.8	41.9	42.0	34.3
Total	**195,268**	**25.0**	**23.4**	**24.8**	**26.9**	**24.6**	**25.2**
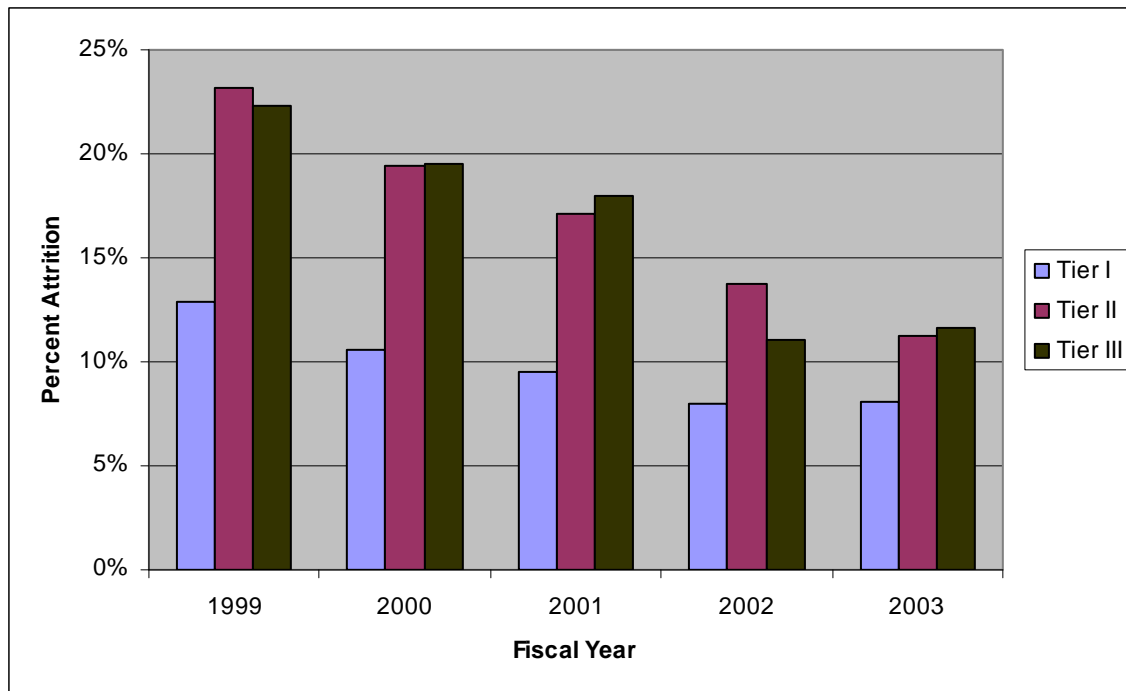
Figure 5.   Initial Training Attrition Rates (Percent) by
Educational Tier Classification, Fiscal Years 1999
through 2003 (After DMDC, 2009)

Using Maximum Likelihood Estimation (MLE), a probit
model was used (with marginal effects computed) to analyze
the data and to test for statistical significance. Based on
research discussed in Chapter II, variables identified as
having potential effects on attrition were included in the
model specified below. Fiscal year dummy variables were
included to improve model specification. The base for the
model was once again an "average recruit," specifically, a
Tier I/education credential "L," single, white, 20-year old
male with no dependents, with an AFQT score of 59, and who
entered the Navy on active duty in fiscal year 1999.
Variable descriptions bore no substantive difference from
those noted in Chapter III.

Two models were constructed to analyze the first-term attrition of survivors of initial training. Both are as specified in Chapter III, with the only difference being the sample used.

The regression results for the model using only educational Tiers, presented in Table 17, shows that most variables have similar coefficients as the regression using the sample that includes initial training attrites. All other factors held constant, "single with dependents" remains strongly correlated with likelihood of attrition. In addition, being a member of any race other than White again results in a lower attrition probability, although the effect is lessened somewhat when only initial training survivors are considered.

Although many coefficients are similar, some show considerable changes. For example, while women still have a higher likelihood of attriting than do men, the new coefficient is much smaller, meaning that the difference between men and women is negligible once initial training has been completed. Also, while persons who have children are somewhat more likely to attrite during initial training than is the "average recruit," that difference becomes statistically insignificant once the first 90 days of service are complete. Most intriguing of all, although older recruits are more likely to attrite during initial training, once the 90-day point has been passed, these recruits are actually *less* likely to attrite.

Table 16. Probit Regression Results using Educational Tiers, Survivor Sample (After DMDC, 2009)

Variable	Coef.	Std Err	Z	P>|z|	dF/dx	Mean
afqt	-0.00158***	0.000056	-28.02	0.000	-0.00158***	58.934
female	0.0683***	0.00264	2.60	0.009	0.00683***	0.172
sngwdep	0.0540***	0.00514	10.95	0.000	0.0540***	0.045
marriednokids	-0.0178***	0.00651	-2.68	0.007	-0.0178***	0.023
marriedwkids	0.00115	0.00598	0.19	0.848	0.00115	0.030
age	-0.00160***	0.000391	-4.09	0.000	-0.00160***	19.838
black	-0.0156***	0.00260	-5.94	0.000	-0.0156***	0.200
hisp	-0.0629***	0.00281	-20.97	0.000	-0.0629***	0.127
apina	-0.0547***	0.00327	-15.72	0.000	-0.0547***	0.088
othrace	-0.0384***	0.00880	-4.16	0.000	-0.0384***	0.011
tier2	0.175***	0.00476	39.88	0.000	0.175***	0.059
tier3	0.171***	0.00646	28.76	0.000	0.171***	0.031
fy00	-0.0148***	0.00311	4.80	0.000	0.0148***	0.207
fy01	0.0363***	0.00314	11.79	0.000	0.0363***	0.213
fy02	0.0175***	0.00319	5.55	0.000	0.0175***	0.191
fy03	0.0311***	0.00331	9.59	0.000	0.0311***	0.178
Constant	-0.3501***	0.0268	-13.05	0.000		
Observations	195268					
Pseudo R-squared	0.0176					

*** p<0.01, ** p<0.05, * p<0.1

2. Attrition by Education Credential

Table 18 shows that the second regression, using education credentials in place of Educational Tiers, resulted in only minor differences from the variable coefficients shown in Table 17. As in the analysis in Chapter III, the coefficients for the individual education credentials illustrate the variation of attrition likelihoods between education credentials within the same Tiers.

Table 17.   Probit Regression Results using Individual Education Credentials, Survivor Sample (After DMDC, 2009)

Variable	Coef.	Std Err	z	P>|z|	dF/dx	Mean
afqt	-0.00445***	0.000181	-24.58	0.000	-0.00140***	58.934
female	0.0309***	0.00830	3.73	0.000	0.00981***	0.172
sngwdep	0.145***	0.0150	9.72	0.000	0.0478***	0.045
marriednokids	-0.0619***	0.0215	-2.88	0.004	-0.0191***	0.023
marriedwkids	-0.0128	0.0190	-0.67	0.501	-0.00400	0.031
age	-0.00542***	0.00129	-4.19	0.000	-0.00171***	19.838
black	-0.0459***	0.00845	-5.44	0.000	-0.0143***	0.200
hisp	-0.213***	0.0101	-21.06	0.000	-0.0631***	0.127
apina	-0.185***	0.0117	-15.83	0.000	-0.0551***	0.088
othrace	-0.126***	0.0307	-4.11	0.000	-0.0380***	0.011
ed_1	0.504***	0.0167	30.12	0.000	0.180***	0.031
ed_5	-0.186	0.611	-0.30	0.761	-0.0547	0.000
ed_7	0.436***	0.129	3.39	0.001	0.155***	0.001
ed_8	0.434***	0.0176	24.59	0.000	0.153***	0.029
ed_B	0.330***	0.0181	18.25	0.000	0.114***	0.028
ed_C	0.445*	0.267	1.67	0.095	0.158	0.000
ed_D	-0.131***	0.0401	-3.25	0.001	-0.0392***	0.007
ed_E	0.503***	0.0141	35.69	0.000	0.179***	0.045
ed_F	0.133	0.0963	1.38	0.166	0.0438	0.001
ed_G	0.0922	0.488	0.19	0.850	0.0299	0.000
ed_H	0.506***	0.0335	15.08	0.000	0.182***	0.007
ed_J	0.225*	0.123	1.82	0.069	0.0758*	0.001
ed_K	-0.155***	0.0329	-4.72	0.000	-0.0462***	0.012
ed_N	-0.280	0.190	-1.47	0.142	-0.0791*	0.000
ed_R	-0.103	0.451	-0.23	0.820	-0.0312	0.000
ed_W	0.353	0.539	0.65	0.513	0.123	0.000
ed_X	0.732***	0.0414	17.70	0.000	0.272***	0.005
fy00	0.0449***	0.00972	4.62	0.000	0.0143***	0.207
fy01	0.109***	0.00959	11.38	0.000	0.0351***	0.213
fy02	2.0505***	0.00994	5.08	0.000	0.0161***	0.191
fy03	0.0977***	0.0101	9.64	0.000	0.0314***	0.178
Constant	-0.399***	0.0280	-14.27	0.000		
Observations	195264					
Pseudo R-squared	0.0220					

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

3.   Summary of Results

The regression models utilizing the sample of initial training survivors support the conclusions presented in Chapter III.   Table 19 shows that, even though attrition rates drop across the board once individuals pass 90 days of

service, the same pattern of inconsistency within Educational Tiers exists even after completion of initial training. This finding supports the conclusion that the Educational Tiers are not constructed in the most effective manner. For example, in Table 19, the attrition rate for persons with some college and a GED certificate are between 38 and 40 percent. This is about the same as the attrition rate for persons with home schooling (41 percent) or high school dropouts (40 percent). Yet, home schooling falls into Tier II, and high school dropouts are in Tier III.

Table 18.   First-Term Attrition Rates (Percent) of Initial Training Survivors by Selected Education Credentials, Fiscal Years 1999 through 2003 (After DMDC, 2009)

Credential (Tier)	Number in Dataset	Attrition Rate(%)
Dropout (III)	6,098	39.8
Nat'l Guard Youth Challenge (II)	933	52.4
Home School (II)	1,455	41.4
GED (II)	8,863	39.5
Some College (I)	5,570	38.5
Adult Ed (I)	5,377	34.0
HS Grad (I)	162,721	22.8
Associate's (I)	1,415	17.1
Bachelor's (I)	2,303	15.5

The analysis in this chapter also shows that marital status, dependency status, and age all show some potential for use in supplemental screening, perhaps in conjunction with AFQT and education status, to strengthen the Navy's screening of enlistment candidates.

V. IMPROVED SCREENING MODEL

An improved screening tool should incorporate as much of the current system as possible to facilitate ease of transition. AFQT and education level therefore continue to figure prominently in the proposed model. Aspects of alternate screening methods the Navy has used in the past were incorporated into the model to increase its predictive ability and to mitigate the shortcomings of the Educational Tier system.

A. RESTRICTED FIRST-TERM ATTRITION PROBIT REGRESSIONS

To develop a reliable screening tool that supplements AFQT and Educational Tiers with other predictive variables, three probit regression models were constructed that include only variables that could be used to screen applicants for predicted attrition likelihood.[74] The first employs the Education Tier system currently used.

Attrite = B0 + B1(catI) + B2(catII) + B3(catIIIb) + B4(married) + B5(depyes) + B6(age17) + B7(age20plus) + B8(tier2) + B9(tier3) + μ.

This model includes Tier variables as described in Table 9, as well as new AFQT category, marital status, dependency status, and age group variables as described in Table 20. Age groupings were chosen based on prior research discussed in Chapter II and the results of the analysis in

Chapter IV. AFQT categories were chosen as a convenient, well-established means of isolating aptitude levels, as shown in Table 21 (below).

Table 19.   Additional Variable Descriptions and Descriptive Statistics (After DMDC, 2009)

Variable	Description	Mean	Std Dev	Min	Max
catI	= 1 if afqt>92, 0 otherwise	0.0439	0.0004	0	1
catII	= 1 if afqt>64 and afqt<93, 0 otherwise	0.3310	0.0010	0	1
catIIIb	= 1 if afqt>30 and afqt<50, 0 otherwise	0.3560	0.0010	0	1
married	= 1 if married, 0 otherwise	0.0558	0.0005	0	1
depyes	= 1 if dependents>0, 0 otherwise	0.1019	0.0006	0	1
age17	= 1 if age=17 years old, 0 otherwise	0.0471	0.0005	0	1
age20plus	= 1 if age>20 years old, 0 otherwise	0.3832	0.0010	0	1

Table 20.   AFQT Test Score Categories (From CNRC, 2008)

AFQT Test Score	Test Score Category
99 – 93	I
92 – 65	II
64 – 50	IIIA
49 – 31	IIIB
30 – 21	IVA
20 – 16	IVB
15 – 10	IVC
9 – 1	V

The base case for the model is a Tier I, single, 18-19 year-old with no dependents, and with an AFQT score that falls within Category IIIa. The probit results for this restricted model are presented in Table 22. Of particular note is the coefficient for the "tier3" variable. Using

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74 While factors such as race and gender are predictive, Title VII does not permit their use in the screening model.

this particular model as the basis for a new screening tool would result in high school dropouts receiving priority for enlistment roughly equal to Tier II credential-holders, a fact that again draws attention to the inconsistencies in the Tier system.

Table 21.   Probit Results for AFQT Category, Educational Tier, and Selected Variables (After DMDC, 2009)

Variable	Coef.	Std Err	z	P>|z|	dF/dx	Mean
catI	-0.270***	0.0152	-17.78	0.000	-0.0916***	0.044
catII	-0.110***	0.00732	-15.02	0.000	-0.0394***	0.331
catIIIb	0.0794***	0.00726	10.95	0.000	0.0288***	0.356
married	-0.152***	0.0169	-9.04	0.000	-0.0532***	0.056
depyes	0.160***	0.0129	12.44	0.000	0.0594**	0.102
age17	0.0455***	0.0134	3.40	0.001	0.0166***	0.047
age20plus	0.0432***	0.00608	7.10	0.000	0.0156***	0.383
tier2	0.535***	0.0112	47.89	0.000	0.206***	0.064
tier3	0.525***	0.0151	34.66	0.000	0.203***	0.034
Constant	-0.504***	0.00615	-81.91	0.000		
Observations	218707					
Pseudo R-squared	0.0168					

*** p<0.01, ** p<0.05, * p<0.1

The second regression attempts to overcome the imprecision of the Tier classifications by employing individual education credentials (see Table 6). To improve model specificity, records with education credentials "5," "7," "C," "F," "G," "J," "N," "R," "U," and "W" were deleted due to insufficient numbers of each in the dataset. This restriction reduced the dataset to 218,103 observations. The base case is again a single, 18- to 19-year-old with no dependents, with an AFQT score that falls within Category IIIa, and an education credential of "L" (traditional high school graduate).

Attrite = B0 + B1(catI) + B2(catII) + B3(catIIIb) + B4(married) + B5(depyes) + B6(age17) + B7(age20plus) + B8(ed_1) + B9(ed_8) + B10(ed_B) + B11(ed_D) + B12(ed_E) + B13(ed_H) + B14(ed_K) + B15(ed_X) + μ.

Probit results are presented in Table 23. Breaking the Tiers into their respective education credentials has shown that three Tier II credentials ("E"- GED holder; "H"- homeschooled; "X"- National Guard Youth Challenge + GED) have marginal effects indicative of a likelihood of attrition that is at least as high as, or higher than, the marginal effect of the one Tier III credential, "1," with all else held constant. This supports the observation, seen in Table 13, that persons with Tier II credentials attrited at a greater rate than did those with Tier III credentials during fiscal years 1999-2003, even when all other factors were *not* held constant.

Table 22.   Probit Results for AFQT Category, Education Credential, and Selected Variables (After DMDC, 2009)

Variable	Coef.	Std Err	z	P>|z|	dF/dx	Mean
catI	-0.250***	0.0153	-16.30	0.000	-0.0849***	0.0439
catII	-0.103***	0.00735	-14.04	0.000	-0.0369***	0.3311
catIIIb	0.0658***	0.00734	8.96	0.000	0.0238***	0.3559
married	-0.145***	0.0169	-8.58	0.000	-0.0508***	0.0556
depyes	0.146***	0.0129	11.30	0.000	0.0540***	0.1018
age17	0.0249*	0.0135	1.84	0.065	0.00904*	0.0472
age20plus	0.0362***	0.00619	5.85	0.000	0.0131***	0.3829
ed_1	0.542***	0.0152	35.72	0.000	0.210***	0.0339
ed_8	0.406***	0.0160	25.35	0.000	0.156***	0.0298
ed_B	0.322***	0.0162	19.84	0.000	0.123***	0.0288
ed_D	-0.136***	0.0349	-3.89	0.000	-0.0474***	0.0072
ed_E	0.545***	0.0127	42.72	0.000	0.210***	0.0497
ed_H	0.564***	0.0297	19.01	0.000	0.219***	0.0084
ed_K	-0.217***	0.0288	-7.54	0.000	-0.0742***	0.0114
ed_X	0.712***	0.0387	18.43	0.000	0.277***	0.0050
Constant	-0.519***	0.00620	-83.66	0.000		
Observations	218103					
Pseudo R-squared	0.0209					

*** p<0.01, ** p<0.05, * p<0.1

Specification of the third probit regression is identical to the second model, but the dataset has been further restricted by deleting the records of persons who left the Navy within the first 90 days of service. This reduces the number of observations to 194,735. Results are presented in Table 24. Among the differences between the sample that includes initial training attrites and the one with the records of early attrites deleted is that individuals older than 20 years show no more likelihood of attrition than do 18- to 19-year-olds. Also, Tier II credentials "E" (GED holders) and "H" (homeschooled) show a slightly lower likelihood of attrition than does Tier III credential "1." At the same time, the Tier II credential

"X" (National Guard Youth Challenge + GED) continues to show a very strong, positive likelihood of attrition.

Table 23.   Probit Results for AFQT Category, Education Credential, and Selected Variables: Initial Training Survivors (After DMDC, 2009)

Variable	Coef.	Std Err	z	P>|z|	dF/dx	Mean
catI	-0.200***	0.0169	-11.84	0.000	-0.0589***	0.0458
catII	-0.0782***	0.00816	-9.59	0.000	-0.0244***	0.3365
catIIIb	0.0592***	0.00817	7.25	0.000	0.0188***	0.3523
married	-0.181***	0.0192	-9.41	0.000	-0.0537***	0.0537
depyes	0.125***	0.0145	8.62	0.000	0.0408***	0.0977
age17	0.0567***	0.0147	3.86	0.000	0.0182***	0.0481
age20plus	-0.00654	0.00691	-0.95	0.344	0.00206	0.3765
ed_1	0.505***	0.0169	29.86	0.000	0.181***	0.0313
ed_8	0.430***	0.0176	24.43	0.000	0.152***	0.0286
ed_B	0.313***	0.0180	17.35	0.000	0.108***	0.0276
ed_D	-0.155***	0.0398	-3.90	0.000	-0.0464***	0.0073
ed_E	0.504***	0.0143	35.29	0.000	0.180***	0.0455
ed_H	0.498***	0.0334	14.90	0.000	0.179***	0.0075
ed_K	-0.194***	0.0323	-6.01	0.000	-0.0570***	0.0118
ed_X	0.750***	0.0415	18.08	0.000	0.279***	0.0048
Constant	-0.737***	0.00688	-107.17	0.000		
Observations	194735					
Pseudo R-squared	0.0182					

*** p<0.01, ** p<0.05, * p<0.1

B.   SCREENING MODEL DEVELOPMENT AND ALTERNATIVES

Data from Tables 22, 23, and 24 were used to develop matrices that assign scores to individuals based on the marginal likelihood variables from each respective table. These scores represent relative likelihood of successfully completing a four-year enlistment. While based on marginal likelihoods generated by the probit regressions, likelihood varies from regression to regression and matrix to matrix. Scores have therefore been normed to a scale with a maximum of 99 to aid in ease of interpretation from one matrix to the next. For example, based on the individual probit

models, a score of 99 corresponds to a likelihood of success of 83 percent in Figure 6, 89 percent in Figure 7, and 94 percent in Figure 8.

Each matrix contains an area in grey, representing scores that are ineligible for enlistment, based on an arbitrary cutoff score. An advantage of implementing a system such as this is that the Navy can adjust the cutoff score to meet demand, either relaxing enlistment standards or further restricting them, as necessary.

The first matrix, shown in Figure 6, utilizes the current Educational Tier system as a screening variable, and assigns a cutoff score of 65 for eligibility. Analyzing the data in this manner, one would conclude that no Tier II or Tier III individuals should be qualified to enlist without achieving a minimum AFQT score of 65 (Category II), except for those who are married and have no children. This would be a significant change to CNRC policy, which currently allows Tier II and Tier III individuals to enlist with a minimum AFQT score of 50, regardless of marital/dependency status.[75]

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[75] Navy Recruiting Manual – Enlisted, Volume II: Eligibility Requirements, 2-6-1.

Ed Cred	Age Group	AFQT Cat I				AFQT Cat II				AFQT Cat IIIa				AFQT Cat IIIb			
		Married		Single		Married		Single		Married		Single		Married		Single	
		No Deps	Deps	No Deps	Deps	No Deps	Deps	No Deps	Deps	No Deps	Deps	No Deps	Deps	No Deps	Deps	No Deps	Deps
Tier I	18-19	99	93	93	87	93	88	88	82	90	84	84	77	87	81	81	75
	20+	97	91	92	86	92	86	87	81	88	82	83	78	85	79	80	74
	17	97	91	92	86	92	86	86	81	88	82	83	77	85	79	80	74
Tier II	18-19	78	72	73	67	73	67	67	62	69	63	64	58	66	60	61	55
	20+	76	71	71	65	71	65	66	60	67	61	62	56	64	58	59	53
	17	76	70	71	65	71	65	66	60	67	61	62	56	64	58	59	53
Tier III	18-19	78	72	73	67	73	67	68	62	69	63	64	58	66	60	61	55
	20+	77	71	71	66	72	66	66	60	68	62	62	56	65	59	59	54
	17	77	71	71	65	71	66	66	60	68	62	62	56	65	59	59	53

Figure 6.　　Screening Matrix Utilizing Educational Tier System

Utilizing individual education credentials rather than Educational Tier yields a more robust matrix, as shown in Figure 7. A cutoff score of 60 was chosen for enlistment eligibility in this case. This matrix restricts enlistment of Tier II and Tier III slightly more than in the previous matrix, requiring single individuals who have dependents to achieve higher AFQT scores to be eligible, even with the lower cutoff score. It is also more restrictive of Tier I individuals holding education credentials "B" (adult/alternative high school graduate) and "8" (15 college credits + GED).

The final matrix, presented in Figure 8 (below), screens individuals based on likelihood of success beyond the first 90 days of service. A cutoff score of 60 was used to facilitate easy comparison with the otherwise similar matrix in Figure 7. A notable change from the other two matrices can be seen in the age rows, where older individuals actually have a higher likelihood of success. Other than that, the likelihood of success among education

credentials rises noticeably, with the exception of credential "X" (National Guard Youth Challenge + GED). This screening matrix is therefore less restrictive for Tier II and Tier III individuals than are the first two matrices. Since it is more closely aligned with current CNRC policies, it would be the easiest screening matrix to implement.

Ed Cred (Tier)	Age Group	AFQT Cat I				AFQT Cat II				AFQT Cat IIIa				AFQT Cat IIIb			
		Married		Single		Married		Single		Married		Single		Married		Single	
		No Deps	Deps	No Deps	Deps	No Deps	Deps	No Deps	Deps	No Deps	Deps	No Deps	Deps	No Deps	Deps	No Deps	Deps
K (I)	18-19	99	94	94	89	94	89	89	84	91	85	86	80	88	83	83	78
	17	98	93	93	88	94	88	88	83	90	84	85	79	87	82	82	77
	20+	98	93	93	87	93	88	88	83	89	84	84	79	87	82	82	77
D (I)	18-19	97	91	91	86	92	86	87	81	88	83	83	78	86	80	81	75
	17	96	90	91	85	91	85	86	80	87	82	82	77	85	79	80	74
	20+	95	90	90	85	90	85	85	80	87	81	82	76	84	79	79	74
L (I)	18-19	92	86	87	81	87	82	82	77	83	78	78	73	81	76	76	70
	17	91	86	86	80	86	81	81	76	82	77	77	72	80	75	75	70
	20+	91	85	85	80	86	80	81	75	82	77	77	72	80	74	75	69
B (I)	18-19	80	74	74	69	75	69	70	64	71	66	66	61	69	63	64	58
	17	79	73	74	68	74	68	69	63	70	65	65	60	68	62	63	57
	20+	78	73	73	68	73	68	68	63	70	64	65	59	67	62	62	57
8 (I)	18-19	76	71	71	66	71	66	66	61	68	62	63	57	65	60	60	55
	17	75	70	70	65	71	65	65	60	67	61	62	56	64	59	59	54
	20+	75	70	70	64	70	65	65	60	66	61	61	56	64	59	59	54
E (II)	18-19	71	65	66	60	66	61	61	56	62	57	57	52	60	55	55	49
	17	70	64	65	59	65	60	60	55	61	56	56	51	59	54	54	49
	20+	69	64	64	59	65	59	60	54	61	56	56	51	59	53	54	48
1 (III)	18-19	71	65	66	60	66	61	61	56	62	57	57	52	60	55	55	50
	17	70	65	65	59	65	60	60	55	61	56	56	51	59	54	54	49
	20+	70	64	64	59	65	59	60	54	61	56	56	51	59	53	54	48
H (II)	18-19	70	65	65	59	65	60	60	55	61	56	56	51	59	54	54	49
	17	69	64	64	59	64	59	59	54	61	55	55	50	58	53	53	48
	20+	69	63	64	58	64	58	59	53	60	55	55	50	58	52	53	47
X (II)	18-19	64	59	59	54	59	54	54	49	56	50	51	45	53	48	48	43
	17	63	58	58	53	58	53	53	48	55	49	50	44	52	47	47	42
	20+	63	57	58	52	58	53	53	48	54	49	49	44	52	47	47	41

Figure 7.   Screening Matrix Utilizing Individual Education Credentials

Ed Cred (Tier)	Age Group	AFQT Cat I Married No Deps	Married Deps	Single No Deps	Single Deps	AFQT Cat II Married No Deps	Married Deps	Single No Deps	Single Deps	AFQT Cat IIIa Married No Deps	Married Deps	Single No Deps	Single Deps	AFQT Cat IIIb Married No Deps	Married Deps	Single No Deps	Single Deps
K (I)	20+	99	94	93	89	95	91	90	86	93	89	87	83	91	87	85	81
	18-19	98	94	93	89	95	91	89	85	92	88	87	83	91	86	85	81
	17	96	92	91	87	93	89	88	84	91	87	85	81	89	85	83	79
D (I)	20+	97	93	92	88	94	90	89	85	92	87	86	82	90	86	84	80
	18-19	97	93	92	88	94	90	88	84	91	87	86	82	89	85	84	80
	17	95	91	90	86	92	88	87	83	90	85	84	80	88	84	82	78
L (I)	20+	93	89	87	83	89	85	84	80	87	83	82	77	85	81	80	76
	18-19	93	89	87	83	89	85	84	80	87	83	81	77	85	81	79	75
	17	91	87	85	81	87	83	82	78	85	81	80	75	83	79	78	74
B (I)	20+	82	78	77	73	79	75	73	69	76	72	71	67	74	70	69	65
	18-19	82	78	76	72	78	74	73	69	76	72	71	67	74	70	69	65
	17	80	76	75	71	77	73	71	67	74	70	69	65	72	68	67	63
8 (I)	20+	78	74	72	68	74	70	69	65	72	68	66	62	70	66	65	60
	18-19	77	73	72	68	74	70	69	65	72	67	66	62	70	66	64	60
	17	76	72	70	66	72	68	67	63	70	66	64	60	68	64	62	58
E (II)	20+	75	71	69	65	71	67	66	62	69	65	64	60	67	63	62	58
	18-19	75	71	69	65	71	67	66	62	69	65	63	59	67	63	62	57
	17	73	69	67	63	69	65	64	60	67	63	62	58	65	61	60	56
1 (III)	20+	75	71	69	65	71	67	66	62	69	65	63	59	67	63	62	58
	18-19	75	70	69	65	71	67	66	62	69	65	63	59	67	63	61	57
	17	73	69	67	63	69	65	64	60	67	63	61	57	65	61	60	56
H (II)	20+	75	71	70	65	71	67	66	62	69	65	64	60	67	63	62	58
	18-19	75	71	69	65	71	67	66	62	69	65	63	59	67	63	62	57
	17	73	69	68	63	69	65	64	60	67	63	62	58	65	61	60	56
X (II)	20+	65	61	60	55	61	57	56	52	59	55	54	50	57	53	52	48
	18-19	65	61	59	55	61	57	56	52	59	55	53	49	57	53	52	47
	17	63	59	58	53	59	55	54	50	57	53	52	48	55	51	50	46

Figure 8.   Screening Matrix Utilizing Individual
Education Credentials – Initial Training Survivors

C.   POTENTIAL DRAWBACKS

It should be pointed out that the matrices presented in
this chapter would have little to no effect on the screening
of traditional high school graduates or college graduates.
The AFQT cutoff score for these applicants are unlikely to

be raised in the near future, without some drastic improvement in recruiting or increase in the supply of potential recruits. Since roughly 85 percent of the Navy's recruits fall into this category, use of these matrices would affect mainly the first-term attrition rates of the remaining 15 percent.

The attrition rate of this less well-educated 15 percent is considerably higher than that of the "traditional high school or better" group and has much room for improvement. However, even if the Navy were able to achieve the highly improbable by eliminating almost all attrition experienced by this group, overall first-term attrition would only fall from the current average of slightly more than 30 percent, to approximately 25 percent, at best.

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VI. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

A.   SUMMARY

The Educational Tier system was intended to simplify the process by which applicants for enlistment were screened. By assigning each of the numerous education credentials to one of three Tiers, using the historical rates of first-term attrition associated with each credential, the services could quickly and accurately compare applicants and determine their relative likelihood of success. In the twenty-two years since the Tier system was instituted, the number of education credentials has increased along with differences in predictability between these credentials. In some cases, credentials seem totally misplaced, far unlike others in the same Tier. The Tier system has become somewhat inaccurate at predicting the relative success of recruits as a result, and the Navy's first-term attrition rate has remained high despite repeated efforts to reduce it.

In addition to finding weaknesses in the Tier System, the analyses described in Chapters III and IV of this study identify a number of other demographic variables that correlate with the likelihood of attrition. Of these, age, marital status, and dependency status are found to be valid for use in an enlistment screening system. These variables are incorporated with AFQT score and Educational Tier in Chapter V. Three screening tables or "matrices" were then

developed. These are presented as a potential replacement to the current system of screening applicants by AFQT score and Education Credential alone.

Finally, it is noted that employment of the matrices presented in Chapter V can only be expected to improve the attrition rates among persons holding an education credential short of a traditional high school diploma. That is, while demographic variables are useful in predicting differences in the likelihood of attrition from one applicant to the next, a traditional high school diploma is still the most powerful and reliable predictor of first-term attrition available for use in enlistment screening. Demographic variables are only a refinement, or a means of improving the marginal accuracy of education as a predictor.

B. CONCLUSIONS

The findings of this research regarding AFQT score and education are consistent with that of earlier studies. Higher AFQT scores are correlated with a lower likelihood of attrition, and completing traditional high school is a consistently positive indicator of a recruit's chances of success in the military. Education beyond high school is generally associated with an even higher likelihood of success.

Not to be confused with education beyond traditional high school is education credential "8," or "Postsecondary Education with Less than a Degree." Commonly referred to as "some college," it is poorly named because it is not used for applicants who have a high school diploma plus some college credits. Rather, it enables an applicant with a

Tier II or Tier III credential to qualify as a Tier I
applicant by completing a minimum of 15 college credits from
an accredited post-secondary institution.[76] There are no
subject restrictions, other than that the courses be 100
level or above, and the only grading requirement is that the
courses were "successfully completed." Consequently, a
person could qualify by earning 15 physical education
credits taken pass/fail. Judging by the relatively high
attrition rate associated with this credential (47 percent,
as shown in Table 15), this particular credential may have
become a convenient, less-controlled avenue for non-high
school graduates to qualify for enlistment with a lower AFQT
score. Experienced recruiters are likely to be aware of
this loophole to achieving Tier I status and are equally
likely to take advantage of it regularly.

Although education beyond high school correlates to
lower likelihood of attrition (credential "8"
notwithstanding), it does not follow that completing an
"equivalent" high school education equates to a likelihood
of attrition similar to that of traditional high school
graduates. The data show that persons with Tier I
credentials, signifying supposed equivalence to a
traditional high school education, attrite at considerably
higher rates than do those with a traditional diploma. Nor
is completing an alternative educational program necessarily

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[76] For example, a traditional high school graduate (credential "L")
who completes 30 college credits before deciding to enlist is coded as a
"13L," denoting a high school graduate who has 13 years of formal
education. An applicant who drops out of high school after completing
10th grade and then completes 15 college credits is coded as a 108,
denoting a person who finished 10 years of formal education and then
completed 15 or more college credits. Both are considered Tier I
applicants.

better than not completing any at all, at least with respect to first-term attrition. Recruits with a Tier II credential often attrite at rates higher than do those classified as Tier III (i.e., high school dropout). The logical conclusion is that, while an education credential can be useful in predicting the likelihood of attrition, the Tier system as it exists today is flawed.

The demographic variable with the strongest correlation to attrition was found to be "single with dependent(s)." No matter how the data were manipulated, recruits who fell into this category consistently had the highest attrition rates. The probit results, using both the restricted and the unrestricted samples, indicated a strong positive correlation with attrition. This finding led to including dependency status in the screening tables presented in Chapter V.

Finally, some prior research has presumed that attrition during initial training can be extrapolated to explain attrition that occurs over the entire course of a four-year enlistment. This study suggests that, once an individual completes the first 90 days of service, attrition predictors change. The following factors are of greatest concern and demonstrate the importance of focusing on attrition after initial training:

1. Marital Status

Marital status was not a statistically significant predictor of attrition when the data for the entire term of enlistment were analyzed. Once the sample was restricted to only those who had survived the first 90 days of service,

being married with children remained statistically insignificant, but being married with no children was negatively correlated with attrition.

2. Gender

The raw data show slightly higher attrition among women, and the unrestricted probit model supports this, indicating a higher likelihood of attrition for women. However, with the model restricted to only those individuals who survived the first 90 days of service, the data show that women are less than one percentage point more likely to attrite than are men, with all other factors held constant.

3. Age

Most notable of all, the unrestricted model indicates that increasing age is correlated with a higher likelihood of attrition. On the other hand, the restricted model shows that this effect is reversed once the first 90 days of service are controlled, with older recruits who make it through initial training becoming less likely to attrite than their younger counterparts.

Summary

These findings led to incorporating age and marital status into the screening tables. Further, the results justified excluding gender.

C.   RECOMMENDATIONS

1.   Dependency Screening

As previously noted, dependency status is used by CNRC for secondary screening.   However, per the Enlisted Recruiting Manual, dependency waivers are required mainly to spare applicants financial hardship, and may not receive the same scrutiny devoted to other personal issues that require a waiver.[77]   Navy Recruiting District (NRD) Commanding Officers have the authority to approve enlistment of single applicants who have one or two dependents.   Because 98.3 percent of single recruits who enter service with a dependent have just one or two such dependents, either very few single people with more than two dependents attempt to enlist, or waivers are much easier to receive at the NRD level than at the CNRC level.

The process for screening single applicants with a dependent is easily gamed by experienced recruiters who know what their COs want to see in a waiver package.   This, combined with the passive focus of such screening (identification of financial hardship for the applicant as opposed to propensity for attrition from the Navy), results in a process that rarely if ever causes an applicant to be denied enlistment due to dependency status.   Since the data show that single recruits with a dependent are roughly 20 percent more likely to attrite than are their single counterparts without a dependent, it is important that CNRC re-examine its dependency-screening process.   It is also recommended that a cap be placed on such waivers to reduce

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[77] Commander, Navy Recruiting Command, 2-5-1.

the number of persons who enlist with such a high attrition propensity. This restriction could instill a stricter sense of scrutiny in those who grant such waivers.

2.   Education Credential "8"

Education credential "8" can denote one of two things: a potential recruit has completed Job Corps and has obtained a GED certificate; or a potential recruit has successfully completed 15 college credits, regardless of previous education background. As noted above, this arrangement allows persons with Tier II or Tier III credentials, who may not have the AFQT scores to qualify for enlistment, to qualify as a Tier I candidate with a significantly lower AFQT score.

While following this path to Tier I eligibility does require a commitment of time, money, and at least a modicum of effort, all of which could be indicative of a dedicated individual who is likely to follow through on a commitment, the data say otherwise. Recruits with education credential "8" attrited at a rate of 47 percent over the five year period analyzed. The probit results indicate that an individual with this credential is 50 percent more likely to attrite than is a high school graduate, all else held constant.

The dataset does not distinguish between individuals holding credential "8" who are Job Corps and individuals who have achieved this credential by completing 15 college credits. However, the fact remains that the likelihood of attrition associated with this credential is more reflective

of Tier II or Tier III than it is of Tier I, regardless of the background that led to being coded with credential "8."

While the Department of Defense controls the Tier System, it is within the Navy's purview to set a higher standard. It is therefore recommended that the Navy close the loophole that is created by education credential "8." Either academic requirements to achieve this credential should be stricter, or individuals who attempt to enlist with credential "8" should be held to Tier II minimum requirements.

3.   Education Credential "X"

Recruits who enlisted with education credential "X" have completed either the National Guard Youth Challenge or the Seaborne Challenge Corps program, in addition to holding a GED certificate. The attrition rate for these recruits approached 60 percent for the dataset that included the entire first-term and over 50 percent for the subset of those who survived the first 90 days of service.

The probit analysis indicates that recruits holding education credential "X" are an astonishing 83 percent more likely to attrite than is a traditional high school graduate, with all other factors held constant. This increases to more than twice as likely after the first 90 days of service. To put this into context, persons classified as credential "1" (high school dropout) are 61 percent more likely to attrite than is a traditional high school graduate, increasing to 73 percent more likely after the first 90 days of service. It was also shown in the

augmented screening matrices presented in Chapter V that
only credential "X" holders with the highest AFQT scores
show a somewhat more reasonable propensity for attrition.

For these reasons, it is recommended that the Navy
require credential "X" holders to score in Categories I or
II on the AFQT to qualify for enlistment. Alternatively,
the Navy could simply discontinue enlisting recruits who
hold this credential.

4.   More Robust Screening

The data show that wide differences exist in the
attrition rates associated with the various education
credentials. Analysis also shows that the Tier system, as
it is currently designed, does not accurately predict
attrition based on the education credentials assigned to
each particular Tier (see Table 13). However, the analysis
of education credentials supports their use in predicting
attrition as discrete factors, as opposed to being
amalgamated into the three Tiers. It has also been shown
that, among demographic variables, age, marital status, and
dependency status are each predictive of attrition
likelihood. With these findings in mind, it is recommended
that CNRC consider using screening tables such as those
presented in Chapter V, which combine education credentials
individually with demographic characteristics that are shown
to correlate highly with attrition.

5.   Individual Education Credential versus Tier
System

As previously observed, the current Tier system is not
as accurate as it could be in predicting first-term

attrition. Ideally, this would be solved by realigning the education credentials within the Tier system to better reflect differing levels of associated attrition. If that is too drastic a step, for whatever reason, then the Navy should consider screening for enlistment based on individual education credentials and AFQT score, using a system similar to the tables presented in Chapter V, but without the demographic factors.

D.   FUTURE RESEARCH

1.   Expanded Analysis of Education Credentials

Ten education credentials were not included in the data analysis due to unreliably small sample sizes. If all credentials are to be fully integrated into the screening system presented in Chapter V, or if education credentials are to be realigned within the Tiers, or if the current Tier system is to be abandoned in favor of using individual credentials for screening, then several more years worth of cohort data may be required before a complete analysis can be conducted. This expanded analysis would allow more complete models to be developed.

On the other hand, given the small numbers of applicants who hold the missing credentials, it may not be worth waiting to develop an improved screening system. Indeed, the ultimate cost of waiting for analytical "completeness" could be quite high.

2.   Economic Conditions and Attrition

Economic theory predicts that higher unemployment in the civilian job market and/or poor economic conditions

overall will lead to lower attrition from the military. The current economic downturn provides a prime opportunity for research to determine if Navy first-term attrition behaves as predicted by theory.

In addition to general economic research of this nature, further research should be conducted pertaining to how different groups (such as a 20-year-old, white, female, single, with dependents, AFQT score 50, home-schooled) react to these economic stimuli. Results of such an analysis could provide the Navy with a better understanding of what motivates different individuals to succeed in service and complete a first term of enlistment. This could in turn lead to more targeted efforts to reduce attrition in the future.

3.   Assembling Objects Subtest of the ASVAB

The Army Research Institute developed the Assembling Objects (AO) subtest of the ASVAB to measure spatial ability and complex, problem-solving skills.[78] Putka and Bradley recently found a significant correlation between AO subtest scores and attrition in the first 15 months of service among Army soldiers.[79] This finding implies that the AO subtest may be a satisfactory proxy for attrition likelihood, especially if it is found to be independent of demographics, AFQT score, and educational achievement. It may therefore have value as a variable in a screening model. Further

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[78] Henry H. Busciglio et al., *Creation of New Items and Forms for the Project A Assembling Objects Test* (Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences, 1994), 1.

[79] Daniel J. Putka and Kevin M. Bradley, *Relations between Select21 Predictor Measures and First-Term Attrition* (Alexandria, VA: Human Resources Research Organization, 2008), 8.

research should be conducted to determine if the same correlation exists for Navy personnel and, if so, to what extent the new subtest could be used to screen individuals for enlistment.

4. Moral Waivers

While Huth found that having a moral waiver was positively correlated with likelihood of attrition from the Navy, Distifeno found more recently that the relationship between moral waivers and first-term attrition from the Army was ambiguous.[80] Since there is no restriction on the number of individuals the Navy can enlist with a moral waiver, it is important to determine whether or not such a waiver affects attrition. Are too many marginal individuals with a higher likelihood of attrition being allowed to enlist? Has the legal system in the United States changed, with juveniles being more frequently charged with offenses that in the past would not have resulted in criminal charges? These and other questions should be studied to determine if moral waiver policies or practices are leading to an unacceptable level of first-term attrition among those who are receiving waivers.

5. Millennial Generation

The data analyzed in this study were drawn from the first cohorts to include members of the so-called Millennial generation. In 2007, Halfacre analyzed the enlistment patterns of Millennials and determined that there are

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[80] Christopher W. Distifeno, "Effects of Moral Conduct Waivers on First-Term Attrition of U.S. Army Soldiers," (Master's thesis, Naval Postgraduate School, 2008), 57–58.

differences in the factors that influence enlistment decisions across generations.[81]   It may follow that attrition patterns among Millennials are also different in nature from those of preceding generations. Research should be conducted to compare attrition patterns of earlier generations with those of Millennials to determine if recruiting and retention strategies may need to be modified.

6.   Global War on Terrorism

An interesting trend may be developing among college graduates who enlist in the Navy.   In the two years following the terrorist attacks on September 11, 2001, enlistment of college graduates skyrocketed, increasing 89 percent over that time period. During the same two years, first-term attrition of college graduates fell by 25 percent. This may be due to these individuals being drawn to the military out of patriotism. It also may be due to the expansion of the Navy's Special Warfare (SEAL, SWCC) and Special Operations (EOD, Diver) communities, whose enlisted composition has traditionally been comprised of a larger percentage of college graduates than other Navy communities. It is recommended that data be collected and analyzed to determine if this effect has continued, as well as to determine how the Global War on Terrorism is affecting recruiting and first-term attrition among the broader population of all Navy enlistees.

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[81] Kevin M. Halfacre, "Enlistment Decisions of the Millennial Generation: An Analysis of Micro-Level Data," (Master's thesis, Naval Postgraduate School, Monterey, CA, 2007), 60-61.

E.   FINAL REMARKS

Some of the findings in this thesis are very similar to those of other researchers. Generally speaking, higher education correlates with lower attrition likelihood, as does higher AFQT score. Other findings, such as the effect of higher age that occurs at roughly 90 days of service, appear to be a relatively recent development. This particular result leads the researcher to believe that changes in societal influences could have occurred over the recent past.

Determining enlistment decisions based, at least in part, on individual demographic background variables can be useful in reducing first-term attrition. The value of this study lies in its ability to improve the Navy's enlisted screening process at the Navy Recruiting District level, with the ultimate goal of limiting the recruitment of persons with the highest likelihood of leaving prematurely. However, screening individuals using demographic variables, ability indicators, and education level cannot be viewed as a panacea for controlling attrition. Because overall first-term attrition can only be reduced so much through more effective enlistment screening, the Navy should continue to look for other ways to improve average year-to-year attrition rates.   Personnel policies and programs are obviously a more "controllable" factor, especially during difficult periods for recruiting, when screening criteria are typically relaxed.   By determining more controllable influences, the Navy would be able to confront first-term attrition with active measures rather than through reactive screening.

APPENDIX A. TABULATED DATA

Table 24.   Navy Enlistment and Attrition, FY99 – FY03
(After DMDC, 2009)

		Total	FY99	FY00	FY01	FY02	FY03
Enlistees		218,707	47,863	45,770	46,406	40,826	37,842
Attrites		72,272	16,358	15,343	16,029	12,654	11,888
Attrition Rate		33.05%	34.18%	33.52%	34.54%	30.99%	31.41%

Table 25.   Navy Enlistment and Attrition, After First 90
Days of Service, FY99 – FY03 (After DMDC, 2009)

		Total	FY99	FY00	FY01	FY02	FY03
Enlistees		194,735	41,051	40,397	41,466	37,273	34,548
Attrites		48,681	9,603	10,020	11,169	9,181	8,708
Attrition Rate		25.00%	23.39%	24.80%	26.94%	24.63%	25.21%

Table 26.   Navy Enlistment and Attrition by Gender, FY99 –
FY03 (After DMDC, 2009)

Gender		Total	FY99	FY00	FY01	FY02	FY03
Female Enlistees		38,438	8,452	8,260	8,414	6,965	6,347
Female Attrites		13,092	2,923	2,811	2,947	2,210	2,201
Rate		34.06%	34.58%	34.03%	35.02%	31.73%	34.68%
Male Enlistees		180,269	39,411	37,510	37,992	33,861	31,495
Male Attrites		59,180	13,435	12,532	13,082	10,444	9,687
Rate		32.83%	34.09%	33.41%	34.43%	30.84%	30.76%

Table 27.   Navy Enlistment and Attrition by Gender, After First 90 Days of Service, FY99 – FY03 (After DMDC, 2009)

Gender		Total	FY99	FY00	FY01	FY02	FY03
Female Enlistees		33,595	7,143	7,159	7,404	6,270	5,619
Female Attrites		8,315	1,623	1,717	1,949	1,531	1,495
Rate		24.75%	22.72%	23.98%	26.32%	24.42%	26.61%
Male Enlistees		161,140	33,908	33,238	34,062	31,003	28,929
Male Attrites		40,366	7,980	8,303	9,220	7,650	7,213
Rate		25.05%	23.53%	24.98%	27.07%	24.68%	24.93%

Table 28.   Navy Enlistment and Attrition by Age, FY99 – FY03 (After DMDC, 2009)

Age		Records	Attrites	Rate
17		10,298	3,493	33.92%
18		75,118	23,125	30.78%
19		49,493	16,978	34.30%
20		27,040	9,541	35.28%
21		17,028	5,936	34.86%
22		11,115	3,785	34.05%
23		7,956	2,656	33.38%
24		5,421	1,736	32.02%
25		3,734	1,222	32.73%
26		2,794	923	33.04%
27		2,045	662	32.37%
28		1,663	543	32.65%
29		1,361	456	33.50%
30		1,012	346	34.19%
31		813	274	33.70%
32		660	210	31.82%
33		562	192	34.16%
34		594	194	32.66%
Total		218707	72272	33.05%

Table 29.   Navy Enlistment and Attrition by Age, After
              First 90 Days of Service, FY99 – FY03 (After
                          DMDC, 2009)

Age		Records	Attrites	Rate
17		9,363	2,566	24.92%
18		68,203	16,303	21.70%
19		43,850	11,428	23.09%
20		23,748	6,292	23.27%
21		14,885	3,815	22.40%
22		9,734	2,421	21.78%
23		6,977	1,689	21.23%
24		4,763	1,091	20.13%
25		3,263	764	20.46%
26		2,441	577	20.65%
27		1,789	413	20.20%
28		1,442	329	19.78%
29		1,177	284	20.87%
30		851	195	19.27%
31		697	163	20.05%
32		571	126	19.09%
33		475	109	19.40%
34		506	116	19.53%
Total		194,735	48,681	22.26%

Table 30.   Navy Enlistment and Attrition by Race, FY99 –
                      FY03 (After DMDC, 2009)

Race		Records	Attrites	Rate
White		127,264	44,425	34.91%
Black		43,293	14,561	33.63%
Hispanic		26,982	7,326	27.15%
Native American		10,082	3,468	34.40%
Asian/Pac Isl		8,757	1,800	20.55%
Other/Unk		2,329	692	29.71%
Total		218,707	72,272	33.05%

Table 31.   Navy Enlistment and Attrition by Race, After
             First 90 Days of Service, FY99 – FY03 (After
                          DMDC, 2009)

Race		Records	Attrites	Rate
White		111,953	29,282	26.16%
Black		38,832	10,214	26.30%
Hispanic		24,755	5,157	20.83%
Native American		8,934	2,340	26.19%
Asian/Pac Isl		8,149	1,208	14.82%
Other/Unk		2,112	480	22.73%
Total		194,735	48,681	25.00%

Table 32.   Navy Enlistment and Attrition by Marital Status,
                  FY99 – FY03 (After DMDC, 2009)

Marital		Records	Attrites	Rate
Single		206,507	68,072	32.96%
Married		12,200	4,201	34.43%

Table 33.   Navy Enlistment and Attrition by Marital Status,
             After First 90 Days of Service, FY99 – FY03
                       (After DMDC, 2009)

Marital		Records	Attrites	Rate
Single		184,750	46,314	25.07%
Married		10,518	2,519	23.95%

Table 34.   Navy Enlistment and Attrition by
             Marital/Dependency Status, FY99 – FY03 (After
                          DMDC, 2009)

Dependency		Records	Attrites	Rate
Single w/dep		10,393	4,297	41.35%
Married w/>1dep		6,960	2,492	35.80%
Single no dep		196,114	63,774	32.52%
Married no kids		5,240	1,709	32.61%

Table 35.　Navy Enlistment and Attrition by Marital/Dependency Status, After First 90 Days of Service, FY99 – FY03 (After DMDC, 2009)

Dependency		Records	Attrites	Rate
Single w/dep		8,868	2,772	31.26%
Married w/>1dep		5,962	1,494	25.06%
Single no dep		175,882	43,542	24.76%
Married no kids		4,556	1,025	22.50%

Table 36.　Navy Enlistment and Attrition by Dependency Status, FY99 – FY03 (After DMDC, 2009)

Dependency		Records	Attrites	Rate
0 dep		196,416	63,868	32.52%
1 dep		13,615	5,181	38.05%
2 dep		6,711	2,498	37.22%
3 dep		1,838	680	37.00%
4 dep		113	39	34.51%
5 dep		4	2	50.00%

Table 37.　Navy Enlistment and Attrition by Dependency Status, After First 90 Days of Service, FY99 – FY03 (After DMDC, 2009)

Dependency		Records	Attrites	Rate
0 dep		176,148	43,600	24.75%
1 dep		11,720	3,286	28.04%
2 dep		5,732	1,519	26.50%
3 dep		1,560	402	25.77%
4 dep		95	21	22.11%
5 dep		3	1	33.33%

Table 38.   Navy Enlistment and Attrition by Education
            Credential, FY99 – FY03 (After DMDC, 2009)

EdCode		Records	Attrites	Rate
1		7,397	3,725	50.36%
5		7	2	28.57%
7		121	59	48.76%
8		6,495	3,069	47.25%
B		6,279	2,732	43.51%
C		25	11	44.00%
D		1,564	391	25.00%
E		10,832	5,472	50.52%
F		209	77	36.84%
G		10	4	40.00%
H		1,824	971	53.23%
J		128	44	34.38%
K		2,479	534	21.54%
L		180,138	54,504	30.26%
N		78	16	20.51%
R		15	7	46.67%
U		4	0	0.00%
W		7	3	42.86%
X		1,095	651	59.45%

Table 39.   Navy Enlistment and Attrition by Education Credential, After First 90 Days of Service, FY99 – FY03 (After DMDC, 2009)

EdCode		Records	Attrites	Rate
1		6,098	2,426	39.78%
5		6	1	16.67%
7		99	37	37.37%
8		5,570	2,144	38.49%
B		5,377	1,830	34.03%
C		23	9	39.13%
D		1,415	242	17.10%
E		8,863	3,503	39.52%
F		189	57	30.16%
G		8	2	25.00%
H		1,455	602	41.37%
J		117	33	28.21%
K		2,303	358	15.54%
L		162,721	37,087	22.79%
N		71	9	12.68%
R		10	2	20.00%
U		4	0	0.00%
W		6	2	33.33%
X		933	489	52.41%

Table 40.   Navy Enlistment and Attrition by Educational Tier, FY99 – FY03 (After DMDC, 2009)

Ed Tier		Records	Attrites	Rate
Tier I		197,278	61,337	31.09%
Tier II		14,032	7,210	51.38%
Tier III		7,397	3,725	50.36%

Table 41.   Navy Enlistment and Attrition by Educational Tier, After First 90 Days of Service, FY99 – FY03 (After DMDC, 2009)

Ed Tier		Records	Attrites	Rate
Tier I		177,674	41,733	23.49%
Tier II		11,496	4,674	40.66%
Tier III		6,098	2,426	39.78%

Table 42.   Navy Enlistment and Attrition by AFQT Category,
FY99 – FY03 (After DMDC, 2009)

AFQT		Records	Attrites	Rate
Cat I		9,601	2,264	23.58%
Cat II		72,383	21,681	29.95%
Cat IIIa		58,864	20,941	35.58%
Cat IIIb		77,859	27,386	35.17%

Table 43.   Navy Enlistment and Attrition by AFQT Category,
After First 90 Days of Service, FY99 – FY03
(After DMDC, 2009)

AFQT		Records	Attrites	Rate
Cat I		8,914	1,599	17.94%
Cat II		65,537	14,941	22.80%
Cat IIIa		51,682	13,863	26.82%
Cat IIIb		68,602	18,278	26.64%

APPENDIX B. REGRESSION RESULTS

Table 44.   Probit Results, Tiers Intact (After DMDC, 2009)

COEFFICIENT	attrite
afqt	-0.00630***
	(0.000161)
female	0.0710***
	(0.00737)
sngwdep	0.179***
	(0.0133)
marriednokids	-0.00675
	(0.0187)
marriedwkids	0.0395**
	(0.0165)
age	0.00451***
	(0.00109)
black	-0.107***
	(0.00762)
hisp	-0.266***
	(0.00912)
apina	-0.211***
	(0.0105)
othrace	-0.178***
	(0.0278)
tier2	0.526***
	(0.0111)
tier3	0.519***
	(0.0150)
fy00	-0.0144*
	(0.00854)
fy01	0.0143*
	(0.00849)
fy02	-0.0708***
	(0.00886)
fy03	-0.0321***
	(0.00905)
Constant	-0.149***
	(0.0238)
Observations	218707
R-squared	.
Standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Table 45.   Dprobit Results (Partial Effects), Tiers Intact
(After DMDC, 2009)

COEFFICIENT	attrite
afqt	-0.00227***
	(0.0000582)
female	0.0259***
	(0.00271)
sngwdep	0.0669***
	(0.00509)
marriednokids	-0.00243
	(0.00673)
marriedwkids	0.0144**
	(0.00606)
age	0.00163***
	(0.000395)
black	-0.0380***
	(0.00266)
hisp	-0.0910***
	(0.00294)
apina	-0.0729***
	(0.00344)
othrace	-0.0616***
	(0.00914)
tier2	0.203***
	(0.00440)
tier3	0.201***
	(0.00595)
fy00	-0.00519*
	(0.00307)
fy01	0.00518*
	(0.00308)
fy02	-0.0253***
	(0.00313)
fy03	-0.0115***
	(0.00323)
Observations	218707
R-squared	.
Standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Table 46.   Probit Results, Potential Screening Variables
(After DMDC, 2009)

COEFFICIENT	attrite
catI	-0.270***
	(0.0152)
catII	-0.110***
	(0.00732)
catIIIb	0.0794***
	(0.00726)
married	-0.152***
	(0.0169)
depyes	0.160***
	(0.0129)
age17	0.0455***
	(0.0134)
age20plus	0.0432***
	(0.00608)
tier2	0.535***
	(0.0112)
tier3	0.525***
	(0.0151)
Constant	-0.504***
	(0.00615)
Observations	218707
R-squared	.
Standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Table 47.   Dprobit Results (Partial Effects), Potential
            Screening Variables (After DMDC, 2009

COEFFICIENT	attrite
catI	-0.0916***
	(0.00477)
catII	-0.0394***
	(0.00260)
catIIIb	0.0288***
	(0.00265)
married	-0.0532***
	(0.00568)
depyes	0.0594***
	(0.00488)
age17	0.0166***
	(0.00492)
age20plus	0.0156***
	(0.00221)
tier2	0.206***
	(0.00442)
tier3	0.203***
	(0.00601)
Observations	218707
R-squared	.
Standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Table 48.   Probit Results, Education Credentials Broken Out
                (After DMDC, 2009)

COEFFICIENT	attrite
catI	-0.249***
	(0.0153)
catII	-0.103***
	(0.00734)
catIIIb	0.0650***
	(0.00733)
married	-0.147***
	(0.0169)
depyes	0.146***
	(0.0129)
age17	0.0246*
	(0.0135)
age20plus	0.0360***
	(0.00618)
ed_1	0.541***
	(0.0152)
ed_8	0.406***
	(0.0160)
ed_B	0.322***
	(0.0162)
ed_D	-0.136***
	(0.0349)
ed_E	0.544***
	(0.0127)
ed_H	0.564***
	(0.0297)
ed_K	-0.218***
	(0.0288)
ed_X	0.712***
	(0.0387)
Constant	-0.517***
	(0.00619)
Observations	218707
R-squared	.
Standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Table 49.　Dprobit Results (Partial Effects), Education
Credentials Broken Out (After DMDC, 2009)

COEFFICIENT	attrite
catI	-0.0848***
	(0.00485)
catII	-0.0370***
	(0.00260)
catIIIb	0.0236***
	(0.00267)
married	-0.0514***
	(0.00570)
depyes	0.0539***
	(0.00487)
age17	0.00894*
	(0.00493)
age20plus	0.0130***
	(0.00224)
ed_1	0.209***
	(0.00601)
ed_8	0.156***
	(0.00636)
ed_B	0.122***
	(0.00640)
ed_D	-0.0475***
	(0.0118)
ed_E	0.210***
	(0.00504)
ed_H	0.219***
	(0.0118)
ed_K	-0.0744***
	(0.00924)
ed_X	0.277***
	(0.0149)
Observations	218707
R-squared	.
Standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Table 50.   Probit Results, Tiers Intact, Survivors of First
            90 Days of Service (After DMDC, 2009)

COEFFICIENT	attrite
afqt	-0.00501***
	(0.000179)
female	0.0220***
	(0.00829)
sngwdep	0.162***
	(0.0149)
marriednokids	-0.0559***
	(0.0215)
marriedwkids	0.00513
	(0.0189)
age	-0.00483***
	(0.00124)
black	-0.0497***
	(0.00844)
hisp	-0.210***
	(0.0101)
apina	-0.184***
	(0.0117)
othrace	-0.126***
	(0.0307)
tier2	0.498***
	(0.0125)
tier3	0.480***
	(0.0167)
fy00	0.0470***
	(0.00970)
fy01	0.113***
	(0.00956)
fy02	0.0552***
	(0.00991)
fy03	0.0971***
	(0.0101)
Constant	-0.356***
	(0.0269)
Observations	194735
R-squared	.
Standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Table 51.   Dprobit Results (Partial Effects), Tiers Intact, Survivors of First 90 Days of Service (After DMDC, 2009)

COEFFICIENT	attrite
afqt	-0.00158***
	(0.0000565)
female	0.00696***
	(0.00264)
sngwdep	0.0537***
	(0.00515)
marriednokids	-0.0173***
	(0.00653)
marriedwkids	0.00162
	(0.00600)
age	-0.00152***
	(0.000392)
black	-0.0155***
	(0.00261)
hisp	-0.0626***
	(0.00282)
apina	-0.0548***
	(0.00328)
othrace	-0.0381***
	(0.00882)
tier2	0.177***
	(0.00481)
tier3	0.171***
	(0.00646)
fy00	0.0150***
	(0.00312)
fy01	0.0365***
	(0.00314)
fy02	0.0176***
	(0.00320)
fy03	0.0313***
	(0.00332)
Observations	194735
R-squared	.
Standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Table 52.   Probit Results, Potential Screening Variables,
             Survivors of First 90 Days of Service (After
                          DMDC, 2009)

COEFFICIENT	attrite
catI	-0.220***
	(0.0168)
catII	-0.0847***
	(0.00814)
catIIIb	0.0743***
	(0.00808)
married	-0.187***
	(0.0192)
depyes	0.141***
	(0.0145)
age17	0.0795***
	(0.0145)
age20plus	0.00201
	(0.00679)
tier2	0.503***
	(0.0126)
tier3	0.488***
	(0.0169)
Constant	-0.723***
	(0.00683)
Observations	194735
R-squared	.
Standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Table 53.   Dprobit Results (Partial Effects), Potential
Screening Variables, Survivors of First 90 Days
of Service (After DMDC, 2009)

COEFFICIENT	attrite
catI	-0.0646***
	(0.00454)
catII	-0.0265***
	(0.00252)
catIIIb	0.0236***
	(0.00259)
married	-0.0557***
	(0.00532)
depyes	0.0461***
	(0.00491)
age17	0.0257***
	(0.00481)
age20plus	0.000635
	(0.00215)
tier2	0.179***
	(0.00485)
tier3	0.174***
	(0.00654)
Observations	194735
R-squared	.
Standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Table 54.   Probit Results, Education Credentials Broken
Out, Survivors of First 90 Days of Service
(After DMDC, 2009)

COEFFICIENT	attrite
catI	-0.200***
	(0.0169)
catII	-0.0782***
	(0.00816)
catIIIb	0.0592***
	(0.00817)
married	-0.181***
	(0.0192)
depyes	0.125***
	(0.0145)
age17	0.0567***
	(0.0147)
age20plus	-0.00654
	(0.00691)
ed_1	0.505***
	(0.0169)
ed_8	0.430***
	(0.0176)
ed_B	0.313***
	(0.0180)
ed_D	-0.155***
	(0.0398)
ed_E	0.504***
	(0.0143)
ed_H	0.498***
	(0.0334)
ed_K	-0.194***
	(0.0323)
ed_X	0.750***
	(0.0415)
Constant	-0.737***
	(0.00688)
Observations	194735
R-squared	.
Standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Table 55.   Dprobit Results (Partial Effects), Education
              Credentials Broken Out, Survivors of First 90
                  Days of Service (After DMDC, 2009)

COEFFICIENT	attrite
catI	-0.0589***
	(0.00462)
catII	-0.0244***
	(0.00253)
catIIIb	0.0188***
	(0.00261)
married	-0.0537***
	(0.00535)
depyes	0.0408***
	(0.00488)
age17	0.0182***
	(0.00479)
age20plus	-0.00206
	(0.00218)
ed_1	0.181***
	(0.00657)
ed_8	0.152***
	(0.00673)
ed_B	0.108***
	(0.00665)
ed_D	-0.0464***
	(0.0112)
ed_E	0.180***
	(0.00552)
ed_H	0.179***
	(0.0131)
ed_K	-0.0570***
	(0.00878)
ed_X	0.279***
	(0.0165)
Observations	194735
R-squared	.
Standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

BIBLIOGRAPHY

Bownds, Christopher D. "Updating the Navy's Recruit Quality Matrix: An Analysis of Educational Credentials and the Success of First-Term Sailors." (Master's thesis, Naval Postgraduate School, Monterey, CA, 2004).

Buddin, Richard J. *Analysis of Early Military Attrition Behavior* (Santa Monica, CA: RAND Corporation, 1984).

Buddin, Richard J. *Success of First-Term Soldiers: The Effects of Recruiting Practices and Recruit Characteristics* (Santa Monica, CA: RAND Corporation, 2005).

Busciglio, Henry H., Dale R. Palmer, Ivey H. King, and Clinton B. Walker. *Creation of New Items and Forms for the Project A Assembling Objects Test* (Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences, 1994).

Cardona, Robert, and Elspeth Cameron Ritchie. "Psychological Screening of Recruits Prior to Accession in the U.S. Military." *Recruit Medicine.*, 297–309. Washington, DC: Office of the Surgeon General, U.S. Department of the Army, 2006.

Cooper, Richard V. L. *Military Manpower and the All-Volunteer Force* (Santa Monica, CA: RAND Corporation, 1977).

Cox, Gerald E., Ted M. Jaditz, and David L. Reese. *The Effect of Enlistment Bonuses on First-Term Tenure among Navy Enlistees.* (Alexandria, VA: Center for Naval Analyses, 2003).

Cymrot, Donald J., and Ann D. Parcell. *Quantity and Quality of Attrition*, (Alexandria, VA: Center for Naval Analyses, 2000)

Distifeno, Christopher. "Effects of Moral Conduct Waivers on First-Term Attrition of U.S. Army Soldiers." (Master's thesis, Naval Postgraduate School, Monterey, CA, 2008).

Eitelberg, Mark J., Janice H. Laurence, Brian K. Waters, and Linda S. Perelman. *Screening for Service: Aptitude and Education Criteria for Military Entry* (Alexandria, VA: Human Resources Research Organization, 1984).

Elster, Richard S., and Eli S. Flyer. *A Study of the Relationship Between Education Credentials and Military Performance Criteria* (Monterey, CA: Naval Postgraduate School, 1982).

Flyer, Eli S. "Development of an Enlistment Screening Measure for Navy Recruits," Unpublished manuscript, 2008.

Flyer, Eli S. *Factors Relating to Discharge for Unsuitability Among 1956 Airman Accessions to the Air Force* (Lackland AFB, TX: Personnel Laboratory, Wright Air Development Center, 1959).

Flyer, Eli S., and Richard S. Elster. *First Term Attrition Among Non-Prior Service Enlisted Personnel: Loss Probabilities Based on Selected Entry Factors* (Monterey, CA: Naval Postgraduate School, 1983).

Folchi, John S., Steven E. Devlin, and Thomas Trent. *Development and Evaluation of a Compensatory Screening Model for Navy Non-High School Diploma Graduate Applicants.* (San Diego, CA: Navy Personnel Research and Development Center, 1993).

Frabutt, Anthony W. "The Effects of Pre-Service Legal Encounters on First-Term Unsuitability Attrition in the U.S. Navy." (Master's thesis, Naval Postgraduate School, Monterey, CA, 1996).

Franke, David B. "An Evaluation of Marine Corps Educational Credentials." (Master's thesis, Naval Postgraduate School, Monterey, CA, 1983).

Gardner, Daniel E. "The Relationship of Initial Assignment and Personal Background Variables to First Term Enlisted Attrition from the Navy." (Master's thesis, Naval Postgraduate School, Monterey, CA, 1980).

Ginzberg, Eli, James K. Anderson, Sol W. Ginsburg, and John L. Herma. *The Ineffective Soldier: Lessons for Management and the Nation, Volume One: The Lost Divisions* (New York: Columbia University Press, 1959)

Goldberg, Matthew S. *New Estimates of the Effect of Unemployment on Enlisted Retention.* (Alexandria, VA: Center for Naval Analyses, 1985).

Golding, Heidi L. W., James L. Gasch, David Gregory, Anita U. Hattiangadi, Thomas A. Husted, Carol S. Moore, Robert W. Shuford, and Daniel A. Seiver. *Fleet Attrition: What Causes It and What to do About It.* (Alexandria, VA: Center for Naval Analyses, 2001).

Golfin, Peggy A., and Amanda B. N. Kraus. *Analysis of the Navy's Increased Cap on Accessions of Non-High-School Diploma Graduates in FY99.* (Alexandria, VA: Center for Naval Analyses, 2001).

Golfin, Peggy A., and Lynda G. Houck. *Effectiveness of the HP3 Screen for Non-High-School-Diploma Graduates: Was FY01 a Better Year?* (Alexandria, VA: Center for Naval Analyses, 2002).

Gunderson, Eric E. K. *Unauthorized Absence, Desertion, and Attrition Rates for First-Term Navy Enlisted: A Twelve-Year Perspective.* (San Diego, CA: Naval Health Research Center, 1978).

Halfacre, Kevin M. "Enlistment Decisions of the Millennial Generation: An Analysis of Micro-Level Data," (Master's thesis, Naval Postgraduate School, Monterey, CA, 2007).

Hoiberg, Anne, C. J. Hysham, and N. H. Berry. *Predictors Related to Premature Attrition of Navy Recruits.* (San Diego, CA: Naval Health Research Center, 1973).

Huth, Richard A. "The Effect of Moral Waivers on the Success of Navy Recruits." (Master's thesis, Naval Postgraduate School, Monterey, CA, 2007)

Knapp, Dierdre J., Eric D. Heggestad, and Mark C. Young. *Understanding and Improving the Assessment of Individual Motivation (AIM) in the Army's GED Plus Program.* (Alexandria, VA: Human Resources Research Organization, 2004).

Koltko-Rivera, Mark E., and David W. Niebuhr. *The Entry Psychiatric Screen (EPS): A Psychiatric Screening Procedure for Applicants for Military Service.* (Winter Park, FL: Professional Services Group, 2004).

Laurence, Janice H. *Education Standards for Military Enlistment and the Search for Successful Recruits* (Alexandria, VA: Human Resources Research Organization, 1984).

Laurence, Janice H. *Secondary Education Credentials: A Military Enlistment Policy Dilemma* (Alexandria, VA: Human Resources Research Organization, 1983).

Laurence, Janice H., and R. Gene Hoffman. *A Description and Evaluation of Selection and Classification Models.* (Alexandria, VA: Human Resources Research Organization, 1993).

Laurence, Janice H., Jennifer Naughton, and Dickie A. Harris. *Attrition Revisited: Identifying the Problem and Its Solutions.* (Alexandria, VA: Human Resources Research Organization, 1996).

Laurence, Janice H., Peter F. Ramsberger, and Jane M. Arabian, *Education Credential Tier Evaluation* (Alexandria, VA: Human Resources Research Organization, 1997).

Lockman, Robert F. *Chances of Surviving the First Year of Service: A New Technique for Use in Making Recruiting Policy and Screening Applicants for the Navy* (Arlington, VA: Center for Naval Analyses, 1975).

Lockman, Robert F. *Enlisted Selection Strategies* (Arlington, VA: Center for Naval Analyses, 1974).

Lockman, Robert F. *Success Chances of Recruits Entering the Navy (SCREEN)* (Arlington, VA: Center for Naval Analyses, 1977).

Lockman, Robert F., and John T. Warner. *Predicting Attrition: A Test of Alternative Approaches.* (Arlington, VA: Center for Naval Analyses, 1977).

Lockman, Robert F., and Patrice L. Gordon. *A Revised SCREEN Model for Recruit Selection and Recruitment Planning* (Arlington, VA: Center for Naval Analyses, 1977).

Lockman, Robert F., and Philip M. Lurie, *A New Look at Success Chances of Recruits Entering the Navy (SCREEN)* (Alexandria, VA: Center for Naval Analyses, 1980).

Lockman, Robert F., Christopher Jehn, and William F. Shughart II, *Models for Estimating Premature Losses and Recruiting District Performance* (Arlington, VA: Center for Naval Analyses, 1976).

Means, Barbara, and Linda S. Perelman. *The Development of the Educational and Biographical Information Survey* (Alexandria, VA: Human Resources Research Organization, 1984).

Military Attrition: DoD Could Save Millions by Better Screening Enlisted Personnel. (Washington, DC: United States General Accounting Office, 1997).

Military Personnel: First-Term Recruiting and Attrition Continue to Require Focused Attention. (Washington, DC: United States General Accounting Office, 2000).

Navy Recruiting Manual – Enlisted, Volume II: Eligibility Requirements (Millington, TN: Commander, Navy Recruiting Command, 2008)

Neuhalfen, Jon K. "Analysis of Recruit Attrition from the Navy's Delayed Entry Program and Recruit Training Command." (Master's thesis, Naval Postgraduate School, Monterey, CA, 2007).

Noble, John. Email message to Wayne Wagner, December 8, 2008.

Population Representation in the Military Services: Fiscal Year 2002. (Arlington, VA: Office of the Undersecretary of Defense, Personnel and Readiness, 2004).

Powers, Rebecca J. "Effects of N-AFMET on Enlisted First-Term Attrition." (Master's thesis., Naval Postgraduate School, Monterey, CA, 1995).

Putka, Daniel J., and Kevin M. Bradley, *Relations between Select21 Predictor Measures and First-Term Attrition* (Alexandria, VA: Human Resources Research Organization, 2008).

Putka, Daniel J., and William J. Strickland, *A Comparison of the FY03 and FY99 First Term Attrition Study Cohorts* (Alexandria, VA: Human Resources Research Organization, 2005).

Ramsberger, Peter F., Janice H. Laurence, Rodney A. McCloy, and Ani S. DiFazio. *Augmented Selection Criteria for Enlisted Personnel.* (Alexandria, VA: Human Resources Research Organization, 1999).

Rostker, Bernard. *I Want You: The Evolution of the All-Volunteer Force*, (Santa Monica, CA: RAND Corporation, 2006).

Sands, William A. "Enlisted Personnel Selection for the U.S. Navy." *Personnel Psychology* 31, no. 1 (1978).

Scroggins, Wesley A., Steven L. Thomas, and Jerry A. Morris. "Psychological Testing in Personnel Selection, Part I: A Century of Psychological Testing." *Public Personnel Management* 37, no. 1 (2008).

Strickland, William J., Chad H. Van Iddekinge, Daniel J. Putka, Rodney A. McCloy, and Huy Le. *A Longitudinal Examination of First Term Attrition and Reenlistment among FY1999 Enlisted Accessions.* (Alexandria, VA: Human Resources Research Organization, 2005).

Trent, Thomas, and Steven E. Devlin. *Compensatory Screening Model for B Cell Enlistment.* (San Diego, CA: Navy Personnel Research and Development Center, 1995).

White, Leonard A., Mark C. Young, Eric D. Heggestad, Stephen Stark, Fritz Drasgow, and Gene Piskator. *Development of a Non-High School Diploma Graduate Pre-Enlistment Screening Model to Enhance the Future Force.* (Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences, 2004).

White, Michael A., Rorie N. Harris, Jacqueline Mottern, and Naina C. Eshwar. *First Watch on the First Term of Enlistment: A Summary and Update of Results from Version 1 of the First Watch Instruments.* (Millington, TN: Navy Personnel Research, Studies, and Technology, Bureau of Naval Personnel, 2008).

White, Michael A., Rorie N. Harris, Naina C. Eshwar, and Jacqueline Mottern. *Attrition in Navy Recruit Training: An Analysis from the First Watch on the First Term of Enlistment.* (Millington, TN: Navy Personnel Research, Studies, and Technology, Bureau of Naval Personnel, 2008).

Wyatt, James R. "Navy Recruiting and Retention: Yesterday, Today, and Tomorrow." (Master's thesis., Air Command and Staff College, Montgomery, AL, 1999).

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